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ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

John Fritz, President of the American Society of Mechanical Engineers.

The new president of the American Society of Mechanical Engineers, Mr. John Fritz, of Bethlehem, Pennsylvania, lived on a farm until old enough to leave home to learn a trade, when his natural inclination toward mechanics led him to be apprenticed in a small country shop, such as were common in those times, where was practiced the art of blacksmithing and "white smithing," the last named art being one which has long since been merged into the machinist's and other trades. In this shop general blacksmithing was done, and in addition to this forgings were sometimes finished to the degree required for the construction of such simple machines as were used in those days in the coal and iron industries of the section of Pennsylvania in which the establishment was located. Some small engines were built, and there was considerable work on furnaces that were used in iron manufacturing operations.

Young Fritz was not satisfied to do merely what he was told to do in connection with his work, but studied such matters as presented themselves in connection with it, and by reason of this, combined with his rare inventive and executive ability, rose from one position of responsibility to another, until he became one of the chief factors in the development of American iron and steel industries, and practically the creator of at least two of the best known American metallurgical establishments. His work in building up the Bethlehem Iron Company's establishment, and in successfully conducting the mechanical part of its business for many years, is extremely creditable to him in every way, whether we consider his phenomenal success in dealing with purely mechanical problems, or the fact that vast armies of men working under his management and direction always had entire confidence in him and are among his warmest friends and admirers.

Under his management the Bethlehem Works became the best equipped establishment in the world for making T rails, and for a long time remained at the head in that department of industry. Afterwards he fitted it for the production of the heaviest armor plates, gun forgings and rifled guns, and its work, so long as he remained there, was of the highest character.

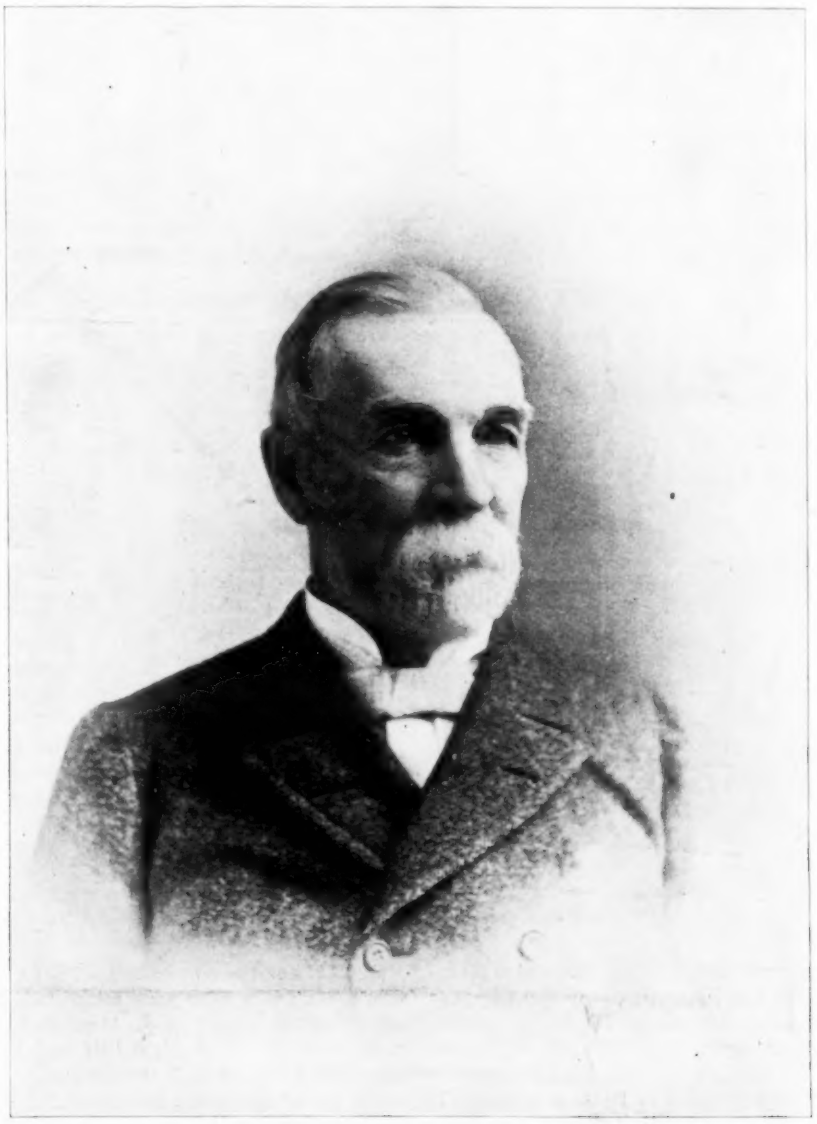
His earlier work in developing and improving rolling mills had made his name known wherever iron is rolled.

Several years ago he built what was at the time the largest steam hammer in the world, a full size wooden model of which was exhibited in the Transportation Department at Chicago, and he is one of the few Americans who have been honored by receiving the Bessemer medal, the recipient of which is each year chosen by the Iron and Steel Institute of Great Britain in recognition of distinguished services in metallurgical work.

Few stories are of greater interest than those which Mr. Fritz can sometimes be induced to tell of the earlier days of iron and steel manufacture—of his invention and construction of the first three-high rolling mill, which was only partially tried when a fire destroyed the mill, whereupon some of those who had predicted the failure of the new method of rolling were quick to say that the fire had been the means taken to conceal utter failure.

Though he has added many millions to the world's stock of wealth and has made many fortunes for others, his own reward, so far, has been only a very modest competence and the consciousness that he has always done his full duty, and has so conducted himself as to command universal respect and the warmest admiration of all who have the pleasure of his acquaintance.

Mr. Fritz is now a little over 73 years of age, and is still apparently in good health. Our engraving is from a recent photograph of him.



JOHN FRITZ, PRESIDENT A. S. M. E.

To be chosen President of the American Society of Mechanical Engineers is an honor of which any man may well feel proud. The position is in itself a very eminent one in the mechanical world, both on account of what it is and what it represents.

Most of the men who have occupied the position have, like the present incumbent, started in life as machinists and have been familiar with the practical branches of machine construction. It is an office to which any machinist who has the capacity for and inclination to mental work may aspire, and is the reward, not of intrigue or wire-pulling, but of actual worth and deserved preeminence among machine constructors.

English Smoke Consumers.

BY W. A. CARLILE.

If the truth must be confessed, most of our English smoke consumers are mere money consumers, and nothing else. The qualities of a good smoke consumer are three-fold: (*a*) It must stop the black smoke that issues from the chimney when a boiler is newly fired; (*b*) It must not cool the heated gases as they pass through the flues, and (*c*) It must do its work well, in spite of the stupidity and carelessness of boiler owners and attendants. It may here be stated, once for all, that such a consumer has yet to be discovered.

Nearly all smoke consumers aim at admitting air to the flame in sufficient quantity to insure perfect combustion. Imperfect combustion means not only the emission of a smoky cloud, which is offensive to the eye of the nuisance inspector, but also the loss of fuel, and the more rapid choking of the flues with what should have been burned.

One form of apparatus admits air in front of the bridge, and another behind it, while a third admits it at the bridge itself. Of the former, one kind admits the air through openings in the door, another through the dead plate in front of the bars, and another through the bar spaces.

The apparatus which admits air through openings in the door is sometimes operated by clock-work. As the door is swung open for firing, a spring is compressed. Then by means of a loaded ratchet escapement, a circular plate centered in the door moves slowly round, and gradually closes the radial openings in the door. The clock-work is so timed that the extra supply of air is shut off when the fire has burned through. Instead of clock-work, a cataract arrangement is sometimes fitted. A loose piston works in a tube filled with water or oil. As the door is opened for firing, the action compresses a spring, and at the same time draws the piston to the top of its stroke. Then when the coal is shoveled in the shutting of the door releases the spring, which tends to force the piston down and close the openings. The flow of the liquid from the lower to the upper side of the piston retards this. The clearance of the piston and the strength of spring are so proportioned that the air is shut off from the door at the proper moment. These two methods are time arrangements.

Of what may be called skill arrangements, the simplest, but not the least efficient, is that in which the attendant leaves the door slightly open after firing, and closes it when he thinks the proper moment has arrived. This method is very effective when the fireman is not sure of his situation. The owner has explained that the next case of a fine paid for non-consumption will mean dismissal and the non-consumption of the owner's money by the attendant; and thereafter, for weeks or months, that employer has a most effective smoke preventer on his premises.

Another arrangement is that of a door in the dead plate. Where this is opened and shut at the proper time, the effect is all that could be desired. Equally good are the results obtained with a variable width of opening along each outer bar of the grate. There are two or three notches in the handle that regulates these openings, the mechanism being below the bars. But alas! for permanent efficiency, the personal equation has become too great. The attendant, encouraged by immunity from smoke, becomes careless, the smoke daily becoming denser, the unwelcome summons appears, and the inoffensive smoke consumer is blamed for it all.

Let us now look at the method by which air is supplied through the bridge. The lower part of the bridge is hollow, while above it is a hollow fireclay ring arching over the bridge. This arch is perforated with many holes. The air is admitted to the hollow bridge through an opening below the bars. It passes up to the arched superstructure, and streams in jets through the small holes. The smoke is consumed, and all is well, and the attendant need not trouble himself about the result, for the whole arrangement is automatic.

But something else comes to mar the general harmony. Gradually the holes get choked with flue dust, and with gritty

particles broken off the fireclay by the action of the heat. Time moves on, all the holes are choked, smoke emerges as before, and recriminations between everybody and everything follow.

No, the perforated arrangement will not do. It is a delusion and a snare. Another traveler for smoke consumers comes along, and his plan is perfect. Hollow bars will admit air to the back of the bridge, and the passage of the air along them will keep the bars cool, and so prolong their life. Two birds are to be killed with one stone, and the owner promptly picks up that stone.

Now there is no denying the fact that tubular bars will prevent smoke, if they are kept open, and it is not hard for them to be so kept. When the openings are clear there is a strong draught through them, so that a small piece of waste held in front of one of them is swiftly drawn through. This gives the manager or owner an easy way of discovering any negligence in the way of cleaning the tubes on the part of the fireman. Yet so careless or obtuse or overworked are so many who could properly overlook this matter that tubes do get choked in spite of the strong draught, the choking usually occurring at the back of the bridge, owing to an accumulation there of flue dust.

However, let us suppose that all is kept clear. Then we have to consider a fault that clings persistently to this type of smoke consumer. Air should be admitted just after firing, and the surplus air shut off a few minutes after. But it is not and cannot easily be shut off, and therefore too much air is passing to the back of the bridge. The consequence is that, though smoke is prevented, yet for the greater part of the time that the fire takes to burn through, the gases are cooled by the surplus air, and heat is lost in consequence.

The simplest and the best of all the methods that we have classified as skill arrangements is probably that of the double bridge. A 9-inch bridge is built at the back end of the bars, as usual. Behind this another bridge is built of about half the width. The space between the two bridges is about 6 inches. At the bottom of the 9-inch bridge is an opening. Through this opening air enters. It then passes up between the two bridges and mixes with the half-burned gases above the bridge. Complete combustion takes place and smoke is prevented. If, in addition, an iron door is placed over the opening at the bottom of the 9-inch bridge, and if this door is hinged and its opening regulated by a rod running under the bars to the hand of the fireman, we have the following result:

The bottom door is opened by the fireman when coal is thrown on, and closed when the fire has become bright; all works well, provided the fireman does his duty, but his duty is two-fold. It is not only that he must move the rod at the proper time, but—and this is of still greater importance—he must see that the space between the two bridges does not get choked up with flue dust.

If he chooses he can clean this out at any time, for by opening the iron door he can get a suitable rake through the opening. If he rakes out the bottom flue dust, more will slide down from above, and thus he can remove all that there is

Without an iron door, a simple brick or two pushed up to or away from the opening has often proved a most effective smoke consumer in the hands of a man who took a real interest in his work. Owing, however, to the fact that low wages rule, and that the cheapest man is too often regarded as the best man—or, which comes to the same thing, that a good man is too often given more than he can do—such care and watchfulness are seldom found. The owner has then to pay out of one pocket, in fines, what he tried to save in the other pocket by cutting down expenses. But present gain bulks more largely than future loss, and so we have black smoke still polluting our towns, the most skilful appliances made useless, and the complaint that inventive power is dying or dead.

One well-meaning employer adopted a simple and effective method of smoke consumption. Six weeks after, he was fined for the emission of smoke. The one who had recommended the smoke consumer visited him and found the apparatus useless through neglect of the smallest attention. The owner, all in good faith, said he had no idea that the arrangement would require to be kept in order; but experience had taught him, and thereafter there was no black smoke and no fines.

In addition to the above, another process has been lately introduced. This consists in washing the smoke with sprays of water before it is allowed to pass up the chimney. It is also claimed for this method that the smoke, plus the water, is a salable article. As, however, a pump is needed to throw the spray, the first cost is increased. The pump has also to be looked after. This means attendance. It has also to be sometimes repaired, which means engineers' bills. These and other items are sufficient to condemn this or any other similar plan, however effective and ingenious.

Birmingham, Eng.

Mexico's International Exposition.

From the general offices of the Mexican International Exposition in New York, we have received the following announcement:

The great International Exposition of Industries and Fine Arts, authorized by the Federal Government of Mexico, by concession dated January 9, 1895, will be inaugurated in the City of Mexico and will remain open for a period of at least six months. It will probably be dedicated on April 2d as a national exhibit, and the formal opening of the International Exposition will take place on September 15th.

The Exposition is to include all kinds of industries, scientific, commercial and artistic productions, and to embrace, in fact, the whole range of human activity.

The Exposition grounds are situated at the foot of the historic Castle of Chapultepec, on the grand Avenue de la Reforma, within ten minutes' ride from the center of the City of Mexico, and comprises an area of over six hundred acres.

The Mexican Government in authorizing this great International Exposition does so with a knowledge of the fact that if the Republic of Mexico is given the proper expansion to the export trade, she will consume one hundred times the amount of imported goods she takes at present.

The Director-General and those who are aiding him are thoroughly conversant with all that is requisite to carry out this the first Exposition ever held in the Sister Republic, and in such a manner as to reflect much credit on the Mexican Government, who have authorized and sanctioned this Exposition under the Act of Congress and the official approval of President Porfirio Diaz.

The fact that an Exposition of this nature will be of great interest to the manufacturers of the United States has prompted the Board of Directors to open general offices at 45 Broadway, New York, where all necessary information can be obtained.

Crumbling of an Aluminum Alloy.

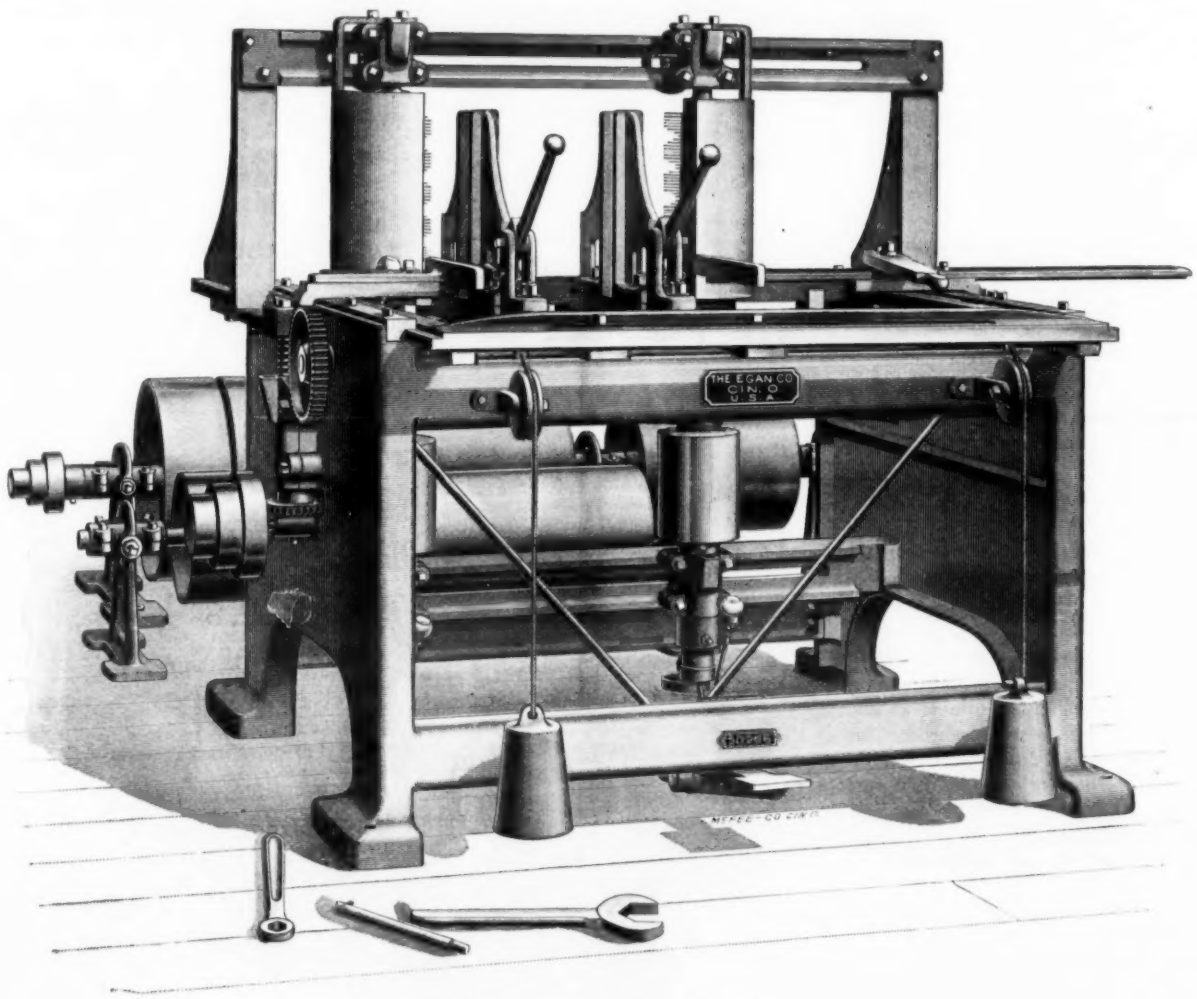
A friend writes us: "The article 'A Perplexed Investigator' (page 931) shows how two men discover the same thing. I think you will want to claim this for an American. Trans. Am. Inst. Mining Eng. Vol. XVIII. (1889–90), page 850, paper on 'Aluminum in Wrought-Iron and Steel Castings,' by W. J. Keep, speaking of alloys of aluminum and iron, 'We then made the proportion 25 per cent. The shrinkage was 0.142 for the square and 0.127 for the thin bar. The crystals were mixed, and the metal would hardly hold together. We next made the proportions half and half. The bars broke by their own weight. The shrinkage of the square bars was 0.241, and the thin bars crumbled too much to be measured. These bars were left in a package for three months, when they had fallen to a fine powder.' I do not know how soon these bars ½ inch square and one foot long became powdered. It was discovered on trying to move the package three months later. This discovery was referred to by Mr. A. E. Hunt, page 551, same volume as above: 'W. J. Keep has pointed out the curious fact that the alloy of 50 per cent. iron and 50 per cent. aluminum, though melted together and seemingly forming a true alloy in the pot and in the metal as first cast, seems entirely to lose its power of cohesion and crumbles down in a little while to a powder, each grain of which seems to contain equal parts of aluminum and iron.' This discovery was therefore made by Mr. Keep six years earlier than by M. Chatelier."

A Double-Lock Corner Machine.

The illustration herewith is that of an improved machine for cutting lock corners for box work. It is capable of taking in material from 2 to 30 inches in length and up to 14 inches in hight, cutting both ends of the stock at the same time, and as many pieces as can be placed in the space of 10 inches. The machine makes every piece alike, and a perfect lock on stock, even when it varies in thickness, and, being double, will in the same time and with the same labor do twice the amount of work of any single machine.

The frame is heavy, is webbed on the inside and strongly braced, and it has ample floor space to insure steady running under all conditions.

The mandrels, large in diameter, run in self-oiling boxes, and are placed vertically, the pulley being between two bearings, and the saws and collars as well. These bearings are a part of the slides which are movable back and forth, with suitable mechanism provided for regulating the different lengths of stock to be cut. The lower box is provided with a step, upon which the mandrel rests, and forms an oil box or chamber for the mandrel to work in; an index plate on the top girt in sight of the operator enables him to adjust the saws to the desired distance.



Double-Lock Corner Machine.

The table is fitted with two upright housings, and eccentric clamps for the stock to rest against; also a set guide on one side and an adjustable one on the other, to bring the stock in line ready to be operated on by the cutters.

The feed is automatic: the stock is clamped in the housings, and the feed carries it through the cutters, after which the weights carry it back finished to the operator, when the machine is ready for another set of boards.

The countershaft is placed on the floor a suitable distance from the machine, and an extra countershaft is placed between it and the machine proper, to enable the belts to run in perfect line on the pulleys of the upright spindles.

The machine has a capacity of about 5,000

boxes of ordinary size in a day of 10 hours. It is made by the Egan Co., 239 to 259 West Front street, Cincinnati, Ohio.

Steel Castings for Anchors.

As an indication of the "state of the art" in the steel casting business, we quote from specifications under which bids were recently received for cast-steel anchors for use in the U. S. Navy.

There are to be made: Five cast-steel navy type anchors, each anchor with stock to weigh 12,000 pounds, total weight of five anchors, 60,000 pounds; and five cast-steel navy type anchors with stock to weigh 14,000 pounds, total weight of five anchors, 70,000 pounds. The anchors to be made of open hearth steel of domestic manufacture.

The castings shall not contain more than six one-hundredths of one per cent. of phosphorus, nor more than four one-hundredths of one per cent. of sulphur, and in all other respects shall be of the best composition.

The castings shall be annealed before the test pieces are taken off. In annealing the mass shall be slowly heated to a cherry red throughout and shall be cooled slowly in the heating furnace, the inspector being cognizant of the periods of time taken in each instance. The heat of the annealing furnace shall be gradually raised to 1,600° Fahr., forty-eight hours being taken to reach this temperature. The casting should then soak for forty-eight hours at 1,600° Fahr. The furnace shall be cooled by the gradual shutting off of the heat, seventy-two hours being required before thorough cooling. In all, 168 hours.

Two test pieces shall be cut from each casting and shall show a tensile strength of at least 55,000 pounds to the square inch, with an elongation of at least 20 per cent. in 8 inches.

One bar from each casting, one inch square, shall bend cold through an angle of 120 degrees over a radius of one-half inch, without showing signs of flaw or fracture.

Each casting shall be slung in chains and raised to a hight of 15 feet from the ground to the lowest part of the casting, as it hangs in the slings. It shall then be let to drop on ground of the hardness of a good macadamized road. It shall then be lifted from the ground, and, hanging in the slings, shall be well hammered over its parts with a sledge hammer weighing not less than 7 pounds, and it shall be required to give under this treatment such a clear ring in all its parts as shall satisfy the inspector that the casting is sound and without flaws existing either originally or developed as the result of these tests.

In addition to the tests already herein prescribed, the inspector shall have the right to call upon the contractor to make such additional tests as he may deem necessary to detect defects or a lack of uniformity in the masses.

The right to reject any casting for surface or other defects shall lie in the inspector.

All parts of the anchors and the anchors after the parts have been assembled shall be subjected to careful inspection before acceptance. All tests herein called for to be made by or in the presence of the inspector and to his satisfaction. The right to reject any material piece or anchor complete which shall fail to meet these requirements shall lie in the inspector.

Anchors weighing more than 4 per cent. in excess of the weights called for shall be rejected, an excess in weight up to 4 per cent. of the weight called for being tolerable, but the department shall not be called upon to pay for any excess in weight, the weight called for deciding the price of the anchor.

Anchors weighing less than the weights called for shall be rejected if such weights fall short by more than 2 per cent. of those called for, and for such of these anchors as may be accepted the department shall pay only for the actual weights.

Bidders were as follows:

The Penn Steel Castings & Machine Co.....	$14,950
The Bethlehem Iron Co.....	16,250
The Midvale Steel Co. Informal. No guarantee.	
American Steel Casting Co.....	17,200

Bicycle Tools—VIII.

STEEL RIMS—CONTINUED.

After brazing the rims go to the same vise hand who scarfed them, the private mark designating the particular workman. A badly scarfed joint is not only discreditable, but is more difficult to file up after brazing than a well-scarfed and closely jointed rim, and it is always possible to improve or injure the appearance of the yellow line of brazing in the steel rim by judicious or careless filing, and hence it would not do at all to have one hand scarf a rim and another file it up after brazing. The filing after brazing takes as long as the scarfing; 40 rims scarfed and 40 rims filed up, a total of 80 operations on the vise, is considered a day's work, though there is some difference in the output of different filers. As this is a piece price operation, the workman has the benefit of his skill and diligence.

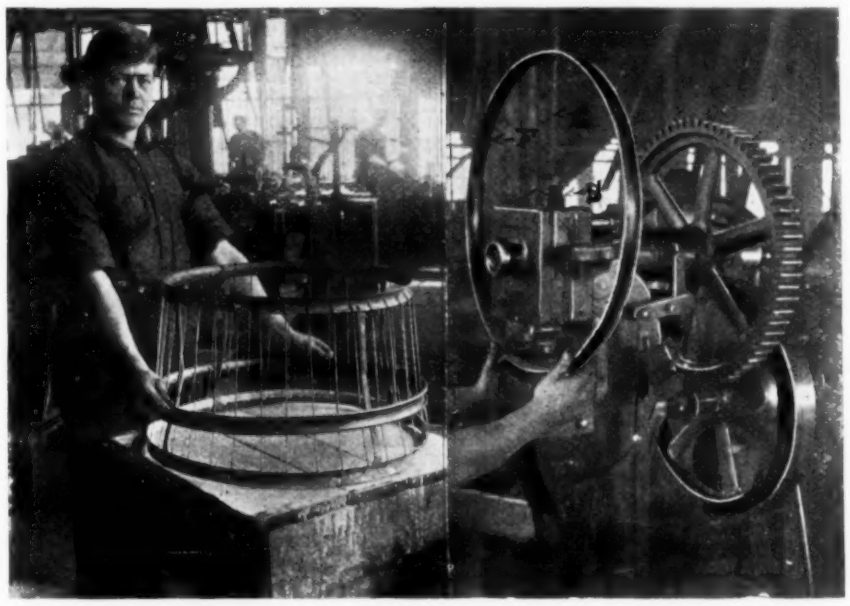


Fig. 61.

Fig. 62.

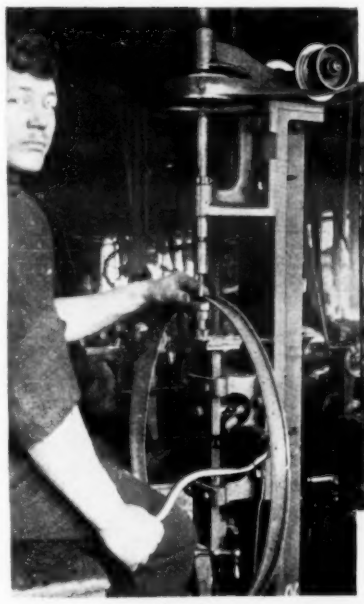


Fig. 63.

Fig. 64.

STEEL RIM MAKING.

The sand blast is used to clean almost all the brazed work in the G. & J. shops, but is not put over the rims; why, I do not know. Perhaps because the brazing is so very clean; owing to the arch form of the rim and the position of the rim at the time of brazing, the borax drips off at the edges of the rim, and the job looks almost perfectly clean as it comes from the fire. The G. & J. sand blast is the simplest and cheapest I have seen so far. It is a direct steam blast, not an air blast, and is extremely effective. It is original with the G. & J. shops, and was the one thing I had to beg for. It will be fully illustrated and described.

From the cleaners the brazed rims go to the spoke hole marker, Fig. 61, to be marked for punching. This marking machine is composed of two steel cycle rims, one larger than the rim to be marked, and one smaller than the rim to be marked. These two rims are connected in two ways: first, by substantial inwardly curving upright supports, which are riveted to the insides of both the base rim and the upper rim, in such a way as to keep the two rims about 15 inches apart, the two rims and the four braces forming the truncated cone frame of the machine. The actual marking part of the device consists of as many stout cords as there are to be spokes in the given rim to be punched; these cords are passed through evenly spaced holes in the top and bottom marking frame rings, stretched tight, and knotted in place. In use these cords are filled with whiting and water with a very slight sizing, or none at all, by rolling the marker in a shallow trough of the whiting mixture. The marker is then placed on a wooden stool as shown, and the rims are marked as rapidly as a workman can handle them over the top rim of the marker and down on the cone until the rim is supported on the marking cords, each one of which leaves a white line on the inside of the rim. This is the only example of a marker of this nature so far seen, and must be regarded as a very unusual combination of elements, and one extremely well suited to its purpose; it marks any diameter of rim within its range of sizes with the desired number of holes; it is very cheap, very durable, extremely rapid in action, and the reservoir of marking material held in the body of the marking strings makes it mark a great many rims at one charging. The engraving gives such a full exhibition of this curious example of simple means applied to produce wholly unexpected effects that no more need be said of it. The spacing of the cycle wheel rim has led to several novel devices which have come under my observation, but none of the others are so entirely outside of the usual methods of graduation as is this effort of Mr. Jeffery, which he himself spoke of as a "queer thing," doing more satisfactory work than queer things commonly perform.

The punching of the spoke holes is done, as shown in Fig. 62, in a press far more powerful than need be, the rim being held upright against a top guide, *G*. This guide is in the form of an upright rod having pin holes at intervals; and this guide is supported at the bottom on a vertically sliding bracket, the hight of which is governed by an adjusting screw at *S*, which has a travel more than equal to the distance between two adjacent pin holes in *G*. In use a pin is put in an approximately suitable hole in *G*, and a rim to be punched is hung on this pin, and the adjusting screw, *S*, Fig. 62, is then moved until the rim just hangs free over the top of the convex die which slackly fills the hollow under side of the rim to be punched, so that the press hand can very easily and quickly slip the rim around, suspended as it is on the pin in *G*, to bring the marks on the rim successively directly under the punch, which almost touches the top inside surface of the rim under his eye. I did not obtain the piece time on this job, which is very rapid in execution, nor did I ask why so powerful a press was used; anything in the way of a press would punch the small hole in the thin stock of the rim. I think this press is by Long & Alstatter, many of whose tools are in use in the G. & J. shops. *F*, Fig. 62, is a joint in the gas fixture, and appears to act also as a guide for the rim. There is distance enough between the die and the stripper to take the rim in any position, and as the gas fixture is used for a guide in the press which punches the brazing rivet hole, it may be so used in this case.

From the spoke hole punch the rim goes to the countersinking machine, Fig. 63, special, by Gormully & Jeffery. This is a simple upright driller, on a T-web frame from the floor, driven with a belt turned under idlers direct to the vertical spindle pulley, *A*. A plain rectangular table slide, *T*, has a small flat table on top, and to this table an adjustable work support is secured, on which the rim to be countersunk is hung. It is needful that the work support should have a fine vertical adjustment, because the vertical table feed is had through the strong stud *S*, secured to the back side of the table slide, and lifted a fixed distance by means of the cam toe seen underneath *S*, this cam toe being solid on a rock shaft extending through a sleeve to the right and front, and having its front end provided with the hand lever grasped by the workman. This hand lever, rocker and cam toe can lift the work table a certain distance only, which makes this sort of feed perfectly suitable for countersinking metal a little more than $\frac{8}{100}$ inch thick, where the slightest over depth of countersink would ruin the whole rim completely. Overlift with this feeding device is impossible, and an under lift is not disastrous. By means of the screw adjustment of the work support on top of the table the countersinking depth is adjusted perfectly, and, although this tool is very simple, its design shows that same perfect selection of means which characterizes so many of the special G. & J. tools. The countersinking tool is simply a common twist drill, ground accurately to gage for angles. The operation is extremely rapid and very easy on the workman, who gives two cuts to each countersink, by carrying the toe a little past the center and back again, thus giving the bit a long dwell and two extreme actions to each hole countersunk, which insures as good work as the tool can be made to do, without the use of any judgment on the part of the operator.

From the countersinking machine the rims go back to the rolling machines and are first re-rolled with the last pass made before scarfing, to give them their true shape which they had before being made ready for brazing by the use of the hammer to spread the trough on one side of the scarf, to make the joint surfaces lie close to each other. They then are given two more passes, once

each through the rolls which form the rim edge hooks under which the rubber tire is secured, using the rolls as previously described, and this finishes the rim in the black.

The next operation is cutting down or rough grinding of the convex inside surface of the rim, shown in Fig. 64. The wheel is 2 inches face, sewed canvas dressed with 120 emery. Like all grinding operations on thin metal this roughing cut requires great skill on the part of the workman; the surface is large and the task is laborious. If the steel is very smooth and free from pits one hand can grind 50 rims per day; a very slight roughness of the stock will reduce the output to 30 rims ground per day, and there seems to be no way to hurry the job. The work must be held in the hands, as although the rims look perfectly true they are not true enough to be subjected to the operations of any automatic grinder using rough wheels. Fifty rims per day per man seems a very small output, but it is the extreme figure reached, and is over the average production by a large percentage.

From the rough grinder the rims are taken under side on two large, light, cast-iron, round-faced carrying pulleys, *C C*, Figs. 65, 66, journaled in cast-iron brackets screwed to the side braces of the main upright frame, *B B*, Figs. 65, 66. There is also a smaller rim-supporting roll, *D*, carried on an awkward bent bracket of round iron screwed to the wooden base brace of the frame, which supports the rim on its under side at the middle point. The two leather driving rolls, *R*, the two large round-edge carrying pulleys, *C C*, and the small supporting roll, *D*, drive and support the rim while it is being polished, the weight of the sliding gate, *A*, being enough to give the rolls, *R*, adhesion on the rim. The polishing elements are: first, a leather strap, *E*, about 18 inches or 20 inches long, hooked at one end to one end of the long coiled spring, *S*, the other end of which is hooked to the shop floor; the other end of the polishing strap, *E*, is hooked to a high, bow arm, round-iron, vertically journaled rock-shaft, *H*, Figs. 65, 66. This bow-arm rocker is journaled in the almost vertical cast-iron bracket, *K K*, screwed to the side of the wooden upright frame, *B B*. The bow-arm of this horizontally vibrating

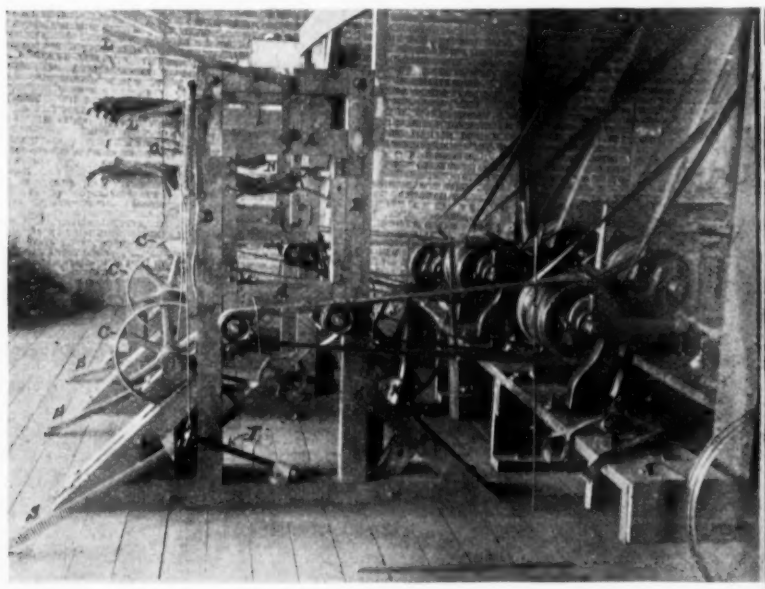


Fig. 65.

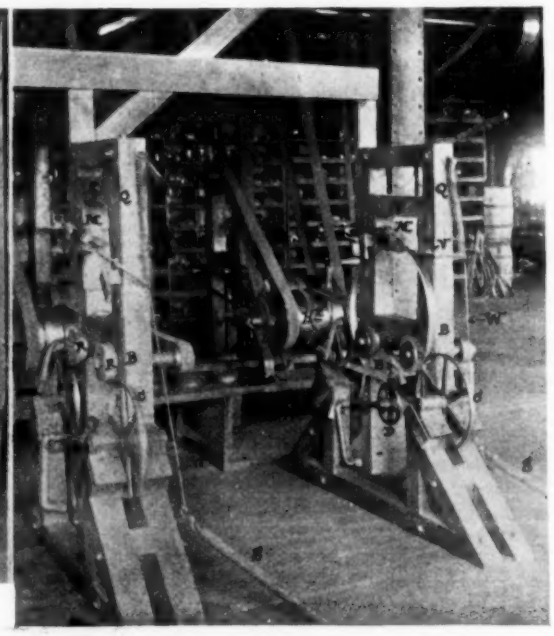


Fig. 66.

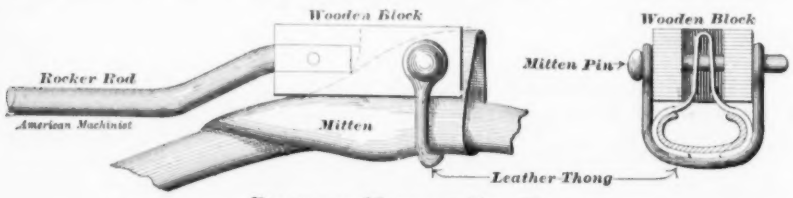
THIS IS A RIM POLISHING MACHINE.

o the automatic polishing machines, six in number, arranged in two banks of three on each side the group of down countershafts which drive them, one bank only being shown in Fig. 65, while Fig. 66 shows the other side of two of the three similar polishing frames in the same bank.

Each of these automatic polishing machines contains the following elements: Two concave faced leather friction driving rolls, *R*, which are independently driven from a down countershaft, and are mounted to run in short sleeves or boxes, which boxes are secured to the under side of a sliding wooden gate, *A*, which moves freely up and down for a short distance between two wooden uprights of a plain braced wooden frame, *B*; this sliding gate, *A*, which carries the rim-driving friction rolls, has a horizontal lifting lever, *L*, pivoted to the top cross beam of the wooden upright frame, with the long end of the lever projecting to the left in Fig. 65, while the short end is connected to a link pivoted to the top cross bar of the sliding wooden gate which carries the friction rolls at the bottom; by pulling down on the outer end of the lever, *L*, Figs. 65, 66, the gate, *A*, is lifted to put a rim into the machine, and when *L* is released the weight of the sliding gate, *A*, is carried by the friction rolls which rest on the inside of the rim to be polished. The rim is supported on its rocker, *H*, is bowed a long way up to pass over the large rim-carrying pulley, *C*, on that side of the machine, and then dropped down on the other side of *C*, to bring its free swinging end, H^2, Fig. 66, in the right place to take the hook on the other end of the leather polishing strap, *E*; H^2 also takes one end of a long crooked round iron connecting rod, *J*, which looks like a crooked wire in Figs. 65, 66. This rod runs to a crank wrist in the side of a small spur wheel carried on a stud at *L* in the down countershaft hanger, which crank spur gear is driven by a pinion on the end of the countershaft. Thus the leather polishing strap is hooked at one end to the long coiled spring, *S*, to the bow-armed rocker, *H*, at the other end, and the rocker, *H*, is connected by a universal joint wrist to the crooked connecting rod, *J*. The rocker journal, *K*, is not quite exactly vertical; it is inclined to the right in Fig. 65; and the result of this whole aggregation is to draw the leather polishing strap back and forth diagonally over the whole convex inner surface of the rim in process of polishing, just exactly as a vise hand would take the ends of a strip of emery cloth in his two hands and fiddle it back and forth across a rounding piece held in the vise to be polished. The steel rim travels around quite fast, and the leather strap, dressed with various grades of polishing material, fiddles merrily back and forth, pulled one way by the connecting rod, *J*, and the other way by the long coiled spring, *S*. These six polishing machines stand in a dark place, where really good photographs could not be had, and their movements are so unusual and their construction so "toggled up" that nothing short of this painfully minute and labored description seems adequate to give an idea of their construction and operation. They are, practically, of thoroughly good design, so far as action is concerned; they surround the problem with appropriate elements of solution; they work well, and will color a rim to beautiful perfection, and they are the only really poorly built tools I saw in the G. & J. shops. I don't believe they were cheap as to first cost, and they must be ranked in the "good but not pretty" class which no man cares to make his own.

The pulled emery strap takes care of the main convex surface of the rim, but leaves the hooked over edges to be polished by the leather "mittens," *M*. These mittens do just what a man's hand would do grasping a rim with a square of emery cloth in its palm, and the hand rolling crosswise of the rim with a wrist action. The "mitten" is a single fold of thick leather dressed with abrasive material and glue, and pinned with a single pin in a wooden fork block, which wooden fork block, *N*, is carried over the top of the rim in the polishing machine on the end of a crooked horizontal rocker shaft journaled in a little bracket at *V*, Fig. 66; at *V* also can be seen this bent horizontal rocker carried round the corner to form the actuating arm of the bent rocker, which arm is hooked to the vertical coiled spring, *Q*, and also hooked to the long downwardly reaching connecting wire, *W*, Figs. 65, 66, which goes down and hooks into the *a* hook carried on the end of the diagonal rocker, *I*, Fig. 65, to which the long coiled spring, *S*, and the polishing strap are also hooked, so that the movement of *I* is transferred to the mitten rocker at *V*. It should be noted that all the movements of the polishing strap and the "mitten" are copied from hand motions, and all this aggregation of rockers and crooked rods and bent arms and springs and hooks and universal joints is simply the mechanic's clumsy imitation of the free universal movements of the human hand on its seven ligament-connected wrist bones; and the machine designer who has once had the task put before him of copying wrist motions in an automatic machine will be inclined to look with lenient eyes on *any* assemblage of parts which will give the complex lines of motion demanded.

As the rim goes round, the strap is drawn back and forth, and the mitten is rocked round and round this way and that way, and the rim is polished to a good "color," which means that it gives optical evidence of a surface of such smoothness that the eye detects no unevenness of finish anywhere.



POLISHING MITTEN.—FIG. 67.

These polishing machines are a good and lesson-giving example of what happens often with a perplexing problem. Haste in execution, a desire for a cheap construction, and the machine partly built before it is wholly designed, give an effective final result of which, although it "works," no one is proud. I have seen many such jobs, and have long ago decided that they are not cheap and not to be advised as good practice. The cheap way and good way lies across the drawing board, and no matter what the temptation to "cut and try" may be, it is always an error to yield to it in the case of a machine which is all easy motions like these polishing machines. With difficult actions, where a cam has more than it can do put on it, or paper or thread are to be handled, trial only can determine the shapes of parts, but in this case I am convinced that an iron frame and well constructed small parts would have been cheaper in dollars and cents of first cost.

Fig. 67 is an enlarged hand sketch detail (from memory) of the "mitten" and mitten block, *N*. After the "mitten" is pinned in place in the cleft of the block, *N*, a leather thong is passed around it and buttoned on the pin, as shown in Fig. 67, to close the large end of the mitten around the rim.

The polishing straps and "mittens" are dressed in four grades with 120, 150, and 180 emery, the last used with oil, and the fourth grade is tripoli for color.

The whole bank of six machines can polish 50 rims per day of 10 hours.

A valued correspondent asks if all details and tools used in polishing, japanning and electro-plating are to be given in these Bicycle Tools articles. In reply I wish to say that every detail of bicyle manufacture, in all materials, rubber, leather, wood, horn and metal, will be treated as fully as information will permit. I am very glad to say that the articles give, already, proof that they are being followed with interest, and no effort will be spared to make them as complete in every particular as possible.

HUGH DOLNAR.

The Holding Power of Lag Screws.

Some time ago I made a few experiments on the holding power of lag screws, the result of which is given below, hoping it may be useful for some of the readers of the AMERICAN MACHINIST. The holes were bored by a common carpenter's bit in 8-inch square logs, and the screws put in same as would be in common practice, and they were pulled out by the use of an Olsen testing machine.

Diameter of screw.	Diameter of bit.	Length of thread screwed into the wood.	Kind of wood.	The load at which screw pulled out.
7/16 inch.	5/16 inch.	3 inches.	Spruce	5,960 lbs.
7/16 "	11/32 "	3 "	"	5,900 "
7/16 "	3/4 "	3 "	"	6,000 "
7/16 "	3/4 "	5 "	"	9,000 "
7/16 "	3/4 "	5 "	Chestnut	9,500 "
3/4 "	5/8 "	4 1/2 "	Spruce	7,000 "
3/4 "	5/8 "	4 1/2 "	Pitchpine	8,300 "
5/8 "	5/8 "	4 "	Spruce	6,000 "
1/2 "	3/8 "	3 1/2 "	"	3,500 "
5/8 "	1/2 "	2 "	"	1,900 "
1/4 "	1/4 "	1 "	"	700 "

This experiment seems to indicate that there is no advantage in using too small a bit when boring holes for lag screws. For instance, the 7/16 screw required full as much force to pull out from a 5/8 hole as it would take to pull out of a 5/8 hole, although it is a great deal easier to put the screw in after a 5/8 bit than it is after a 1/2 bit, and it is certainly work spent in the wrong direction to use a bit smaller than the core of the screw.

By splitting the block and examining the wood around the screws, it will be found that when too small bits are used, the fibers in the wood around the screws are crushed and destroyed, but when the right size of bit is used the thread in the wood around the screw looks clean cut, the texture of the fibers is pressed and the fit in the wood

on the screw resembles the appearance of a nut on a bolt.

When the $\frac{7}{8}$ screw was screwed into a $\frac{3}{4}$ hole its full length of thread, or five inches, it required a force of 9,000 pounds to pull it out; therefore it is safe enough for any temporary job under a steady stress to lift one ton in a $\frac{7}{8}$ lag screw, as this gives about 4 as factor of safety in pulling out of the wood, and there is no danger of pulling off the screw itself, because at the place of the core where it could break it is about $\frac{11}{16}$ inch in diameter = 0.37 square inch area.

Assuming ultimate tensile strength to be 50,000 pounds per square inch, the breaking load would be 50,000 × 0.37 = 18,500 pounds; thus there is no danger at all of the screw itself breaking for a load of a ton.

Fitchburg, Mass. P. LOBBEN.

How to Sell American Goods in Germany.

The United States Consul at Chemnitz, Germany, reports that hardly a mail goes to that city that does not carry with it a letter or letters asking for information as to how to find markets for goods made in the United States.

Twice in each year American houses send from 50 to 75 representatives to buy in Chemnitz, and this is done in all the larger cities of Germany. These men leave orders for sums ranging in the aggregate from twenty-five to thirty or even forty million dollars annually. On the other hand no sooner do these buyers leave the country than the German manufacturers send out their agents with their trunks packed, who sail for the United States, where they cover the country from New York to San Francisco and from Portland, Me., to New Orleans, showing samples and taking orders; more especially is this done where the manufacturers are not represented permanently on this side of the water.

The above-mentioned energy and eagerness is of necessity bearing fruit; success to these people has been so certain that they are already building on larger sales and better times than they have ever experienced. The only way for our merchants to gain and maintain a foothold among these people is to do as they do. Send out agents with well-filled sample cases. Already one American manufacturer has pursued this course and has demonstrated its wisdom, and there are doubtless others who are wise enough to hold their own counsel. This one especial manufacturer had the country covered from Berlin to Chemnitz, and had very successful and numerous sales; but he had one expensive drawback, the necessity to carry an interpreter along. Not only does this run up expenses, but no man wants, if he can help it, to sell his goods by means of an interpreter; nor, on the other hand, does a merchant care to buy his goods in this manner. This ought to prove that where we cannot lead we ought to be perfectly willing to follow, especially when it is undoubtedly to our interest to do so. A. F. TENNILLE.

Compressed Air as a Corrector of Atmospheric Humidity.

BY FRANK RICHARDS.

Probably more actual discomfort is experienced by the residents of the cities along the coast, on account of the humidity of the atmosphere, at different times, than from any other single physical cause. The frequent intervals of suffering from this source in the summer months make the city intolerable for residence to many persons, while to many more, whom circumstances grip too hard for escape, the misery is great. It is my personal experience that a temperature of 95 degrees, when the air is dry, is quite comfortable as compared with a temperature of 80 degrees in combination with high humidity. Not only is the humidity so oppressive in the summer months, but at other seasons also it asserts itself. On November 8th of this year, in New York the air was completely saturated with moisture, or the humidity was officially reported at 8 A. M. as 100 per cent.; at noon of the same day the percentage of humidity was 80, and at 2 P. M. it had risen to 90. The official temperatures at the same times were 58 degrees, 62 degrees and 65 degrees, and the feeling experienced all the day was an extremely uncomfortable one. For several days the conditions were similar, although perhaps not quite so marked. Discomfort to those who are well and vigorous means ill health in various degree to those who are not so strong. Many are sent away by the doctors to Colorado or elsewhere in quest of dry and bracing air, and many more are doomed to stay and sigh for relief that is beyond their reach. The state of things is not mitigated in the least by the fact that many are ignorant of the cause of their misery. It is, no doubt, often attributed to causes other than the right one; but to all alike when the drier air returns the feelings are correspondingly elevated. Why then should not an effort be made to provide the drier air, at least for those who can afford the luxury, when it may be so easily accomplished?

I am not aware that anything has ever been done or seriously proposed as a means of reducing the atmospheric humidity, and thereby increasing the comfort and promoting the health of the community. Various devices are employed, I know, in the summer months for the relief of suffering humanity, the principal one being that of agitating the air by mechanical means. In many places fans swing back and forth unceasingly, driven by a remote steam engine or other motor. The electric fan has of late become quite popular, and is a neat and satisfactory way of producing air currents, and doubtless also of causing colds, neuralgia, and other ailments. All the devices of the summer time look to the cooling of the air or of the person, and not one is aimed at the drying of the air. The places of amusement that are open to the public are each advertised as "the coolest place in the city." Some of the more enterprising announce that their places are artificially cooled by "currents of air that have been passed over tons of ice." There is no doubt that this device has been actually employed, and that the air in some cases has been cooled by this means, but it must be certain that the ice has constantly also contributed more or less of moisture to the air which traversed it, and in the end contributed to the discomfort of those who were to be benefited by it.

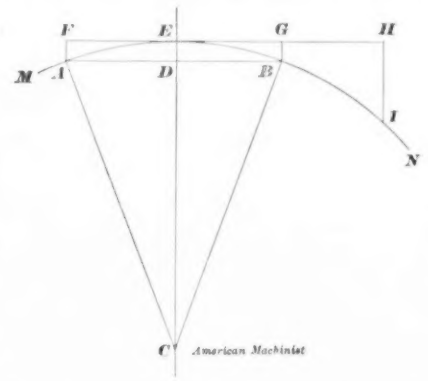
The proposition to use compressed air as a means of cooling has nothing of novelty in it, because every one is, or should be, familiar with the fact that the temperature of air is raised by compression, and that if while under the increased pressure it is allowed to cool to normal temperature, and after that is allowed to expand to normal atmospheric pressure, it must of necessity be considerably colder than it was before the beginning of operations, and the cold air thus produced may be applied in any way most conducive to our comfort. I am not aware, however, that any one has called attention to the fact that the same operation of compression, of cooling while under pressure, and of re-expansion to normal pressure again, dries the air at the same time that it cools it. The capacity of air for moisture varies greatly with both its temperature and its pressure. Air that is saturated with moisture when at normal pressure and temperature may be very dry and thirsty if simply heated, and this fact is taken advantage of in drying operations. In the heating of air by compression the operation is very different from that of simply applying heat from without. Heating air increases its capacity for moisture rapidly, but a reduction of its volume decreases that capacity, and where the two operations go on together, as in adiabatic compression, the one may counteract the other so that the capacity of the air to hold or convey moisture may not undergo much change; but after the operation of compression has entirely ceased, and the air is cooled, while still under the increased pressure, the cooling of it will be like the wringing of a sponge, and the air, if then released, must be much drier than before its compression. If this air is discharged into a room in this dry condition, and at its low temperature, it accomplishes two most desirable things: it displaces some of the hotter and moister air that was present, and mixing with the remainder it reduces the mean temperature, and also the amount of moisture present. By the means here indicated, it is possible to absolutely control both the temperature and the humidity of an apartment, and the two conditions may be entirely independent of each other. After the air has been dried by the compression and cooling it will remain dry, and if the air is too cool it may be given an opportunity to recover any desired temperature without also absorbing moisture.

All this will cost money, or, what is the same, it will require power; but it will represent a great luxury. To get the best results both of drying and of cooling, all doors and windows should be closed, and the compressor should be depended upon for the entire air supply. An allowance of 10 cubic feet of free air per minute for each person is liberal, and if it were necessary to compress this air to a pressure of 50 pounds gage, the horse-power required would be about one horse power for each person. It is probable that it would not be necessary to compress to as high a pressure as that mentioned, and if so, the cost of compression would be proportionately less. Beyond providing the means of compression, the only other expense would be for piping and for suitable controlling valves.

A Little Dangerous Knowledge About Leveling.

BY TECUMSEH SWIFT.

I see that a story has started upon its rounds among the scissors-edited papers about a line shaft that was put up by a lot of machinists and leveled with great care, and was found when finished to be two inches higher in the middle than it was at the ends, and then the story goes on to tell how a schoolboy went to work and figured out very closely the length of the shaft from that two inches of difference in the hight of it, and finally we are told that schoolboys in these days learn when quite young that the earth curves eight inches to the mile, and



they learn, too, the allowance to be made for every fraction of a mile.

Now it seems to me that this story is a good example of what the fellow meant when he said that "A little knowledge is a dangerous thing," because this story, the way they tell it, is a dangerous thing, or a misleading thing, and if a fellow swallows it whole he knows less than he did before, because it is a minus quantity that he is adding to his stock of knowledge. In the first place the incident never happened anywhere, because they don't have line shafts as long as this would have to be, and then it could not have been two inches higher in the middle, or anywhere else, and be level at the same time, because when you get a surface of any kind level, or a line level, like a line shaft, it is all of the same hight, and that is just what level means. Of course a level line is not a straight line, and it cannot be a straight line, because it is a line that is all the way at the same distance from a fixed point, the center of the earth, and these machinists in the story just found out that while their shaft was level it was not straight, and that a straight line connecting the ends would be two inches away from the shaft at the middle.

I went to work and figured out the length of this shaft, the same as the other schoolboy did. The first thing that I did was to make a sketch like the one I show here with C for the center of the earth and M N for a part of the circumference of it. Then if A E B was the line shaft as it was leveled up E D would represent the two inches that it was out of being straight. I took C B and C E to be both of them 4,000 miles, or 253,440,000 inches. This is not the exact measure of the radius of the earth, because nature never does get her measures very correct, but this measure had to do for me. C D then was two inches shorter than C E or C B, and now I had it all fixed to find the length of D B, or one half of the line shaft, because here I had a right-angled triangle, C D B, and the lengths of two of the sides, C B, the hypothenuse, and C D, the long side. Then $(C\ B)^2 - (C\ D)^2 = (D\ B)^2$. After doing the arithmetic I found that D B was 31 839 inches or 2,653 feet, which is only 13 feet over a half a mile, and A B, or the whole length of the shaft, was therefore a little over a mile. I wonder where they are setting up such line shafts as that. If they do use them, or shafts considerably shorter than that, they don't have them of the same diameter the whole length, but have them decrease in size as they get farther away from the driver, and that makes the story that started me on this string more impossible than ever.

Next thing, of course, I had to see how my measure would correspond with that rule given in the story. The earth curves eight inches to the mile, it says, which means, if it means anything, that it runs off at a straight and regular taper, when we all know that it does nothing of the kind. Starting at E with a line tangent to the circumference, if E H is a mile then H I, or the perpendicular from the tangent E H to the circumference, will be eight inches, but the fact that this is eight inches makes it very certain that it cannot be eight inches for any other mile. The curvature is very nearly eight inches for one mile, and the curvature for any other distance is just as the square of the distance; for two miles it is four times as much as for one mile, or 32 inches; for three miles it will be nine times as much as for one mile, or 72 inches, and so on. So for distances less than one mile the same rule is good; for one half a mile the curvature will be one-quarter as much as for a mile, or two inches, which brings me out all right in my calculations. In leveling up a long line shaft by laying a carpenter's level upon each successive length of it no two lengths can be exactly straight with each other. Each one must drop away a little, and the next one a little more, and so on. Their lines will be like the sides of a big polygon, but the deviation from the straight line will, after all, be so slight at any point as to be of no practical importance as far as the running of the shaft is concerned. It would be impossible to detect the difference in friction between such a shaft and one that was absolutely straight. It would be well if all shafts were perfectly level. They would average better running than they do to-day.

If any one does want to have his shaft absolutely straight instead of absolutely level it is as easy to have it one way as the other. A surveyor's level affords a ready means of setting a shaft straight, or so that its axis shall be in the same horizontal plane throughout, and it is a very convenient means of adjusting the hight of shafting. If the shaft is very long the level should be placed near the middle and off to the side, so that it will command the whole shaft, and when it is adjusted a rod with a hook to go over the shaft and with a sliding and adjustable dial is all that is required. The dial is first adjusted to the level upon any part of the shaft that may be assumed to be of the hight desired, and the rest of the shaft may be adjusted to it. A shaft adjusted in this way and level in the middle will point upward slightly at each end, if it is long enough to enable the level to detect it. If

the level is stood at one end of the shaft instead of at the middle of it, the other end of it will be four times as much out of level as in the case where the leveling was done from the middle; but so long as the instrument is kept in one position during the work the shaft will be straight.

An Apparatus for Automatically Recording the Action of a Shaft Governor.

The apparatus described in the following article was designed and constructed by the students in the mechanical engineering department of the University of Illinois. The line passing through *B* and *D*. The dimensions of the pantograph are such that the travel of the pencil is just double the travel of the valve rod. Below the pencil is a plate, *H*, which is covered with a sheet of brass to give a smooth surface. The roll of paper is placed on the roller, *G*; the paper is then led over the plate, *H*, and passes between the rollers, *J* and *I*. The roller, *J*, is attached to a frame which is pivoted at *K* to the standard shown in the figure and the two rollers are held in contact by the spring, *S*. The successful operation of the apparatus requires that the rollers be made of rubber or some similar substance in order to prevent the slipping of the paper.

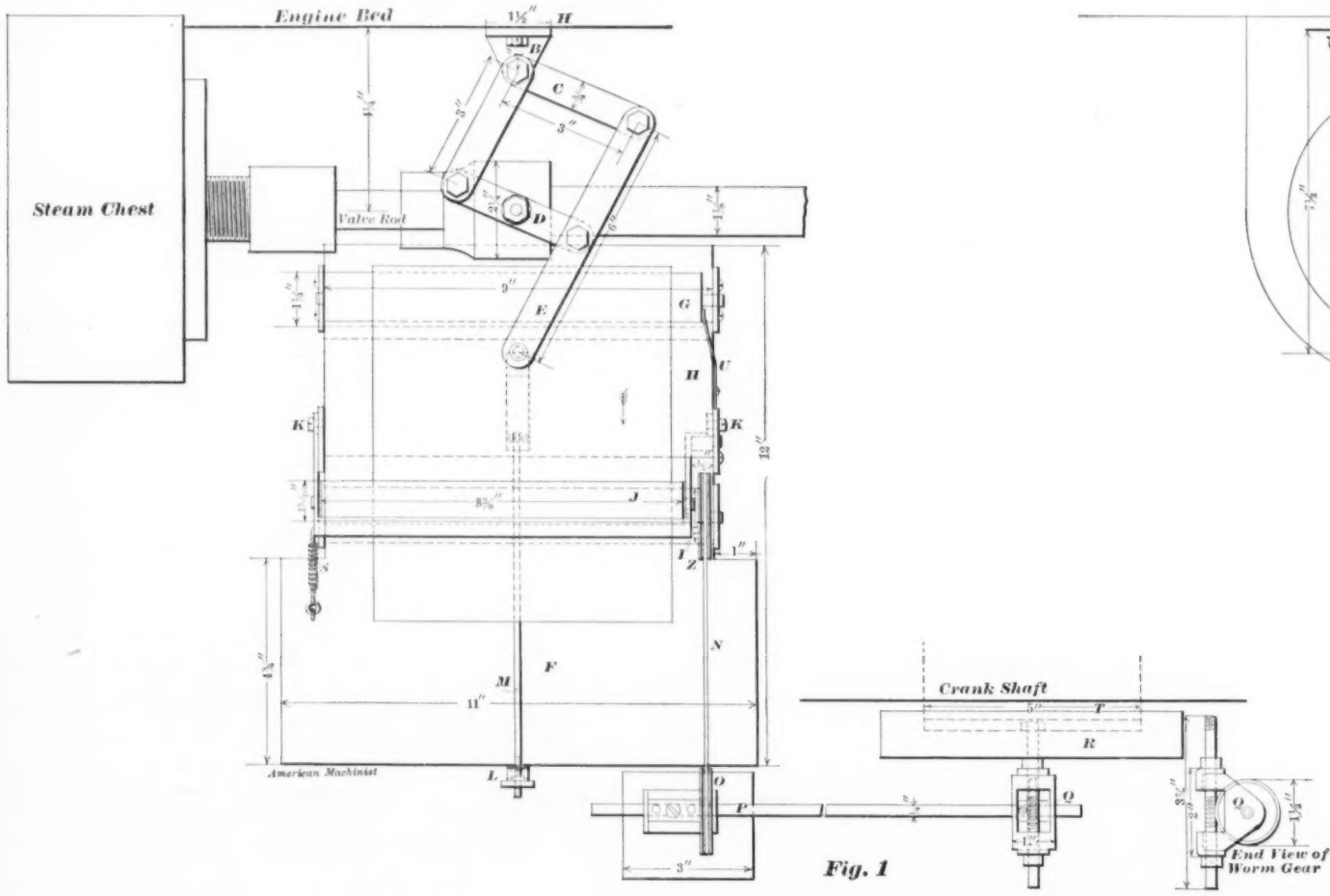


Fig. 1

The motion of the paper is obtained by a worm-wheel arrangement attached to the engine shaft. Over the end of the shaft is fitted a wooden cap, *R*, into which is screwed a bolt carrying a worm thread. The worm wheel, *Q*, drives the roller, *I*, through the worm shaft, *P*, the pulleys, *O* and *Z*, and belt, *N*. It requires one hundred revolutions of the engine shaft to produce one revolution of the roller, *I*.

The plate, *H*, is adjusted to the pencil by means of the rod, *M*, and thumb nut, *L*. The pencil is held to the paper by a small spring.

It is readily seen that the length of the lines of the pencil diagram is directly proportional to the travel of the valve; hence any change in the travel due to the action of the governor is shown by a corresponding change in the length of the lines of the diagram.

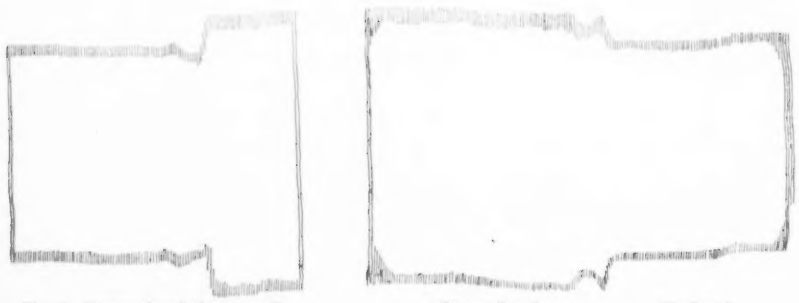
The apparatus was attached to a 10 × 10-in. Ideal engine in the electrical engineering laboratory of the university and a large number of diagrams were obtained. The load was obtained from various dynamos and could be varied at will by opening and closing switches.

Some of the diagrams obtained are shown in the accompanying figures. Unfortunately the originals are too faint to be reproduced by photographic processes, and they could not easily be traced. Hence the figures show merely the locus of the ends of the lines of the diagram. These, however, are traced from the originals and show plainly the number of revolutions and the variations in the lengths of the lines.

Diagram No. 8, Fig. 4, shows the governor's action with heavy load thrown on and off rapidly.

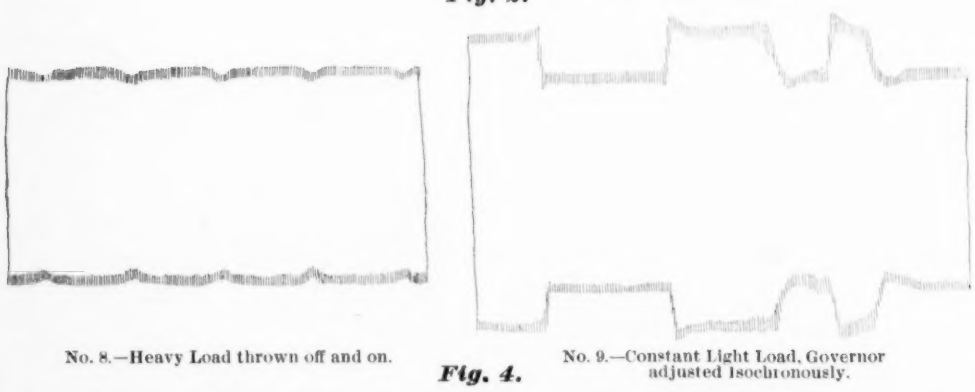
Diagram No. 9, Fig. 4, shows the action with a constant light load, the governors being adjusted isochronously. The wavy diagram shows the racing action of the governor.

Prof. D. S. Jacobus has devised a somewhat similar apparatus for exhibiting the action of the governor. The diagram obtained is a spiral winding about a center which represents the center of the shaft. The radius of the spiral at any point shows the valve travel at that instant. The diagram, however, must be practically instantaneous, not continuous. It is the intention of the mechanical engineering department to design and construct a much better and more accurate instrument and apply it to numerous types of governors. It would seem possible that an instrument of this character might be applied to an engine to test the governor's action just as an indicator is used to detect faults in the steam distribution.



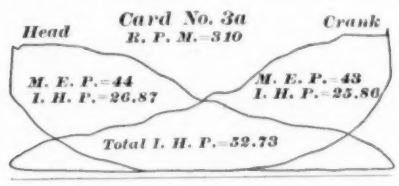
No. 8.—Heavy Load thrown off. Heavy Load. No Load. Card 5.—Heavy Load thrown on.

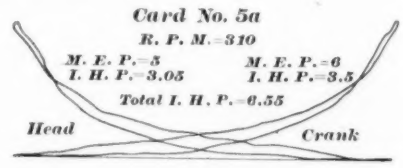
Fig. 2.



No. 8.—Heavy Load thrown off and on. No. 9.—Constant Light Load, Governor adjusted Isochronously.

Fig. 4.





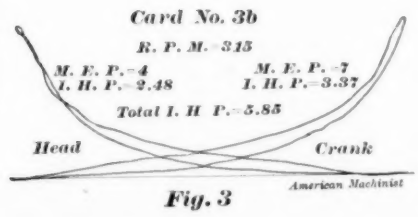


Fig. 3

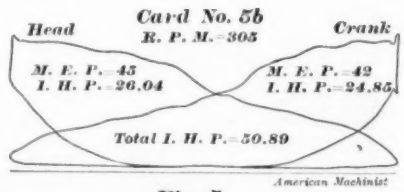


Fig. 5

e xperiments made with the apparatus formed the subject of a graduating thesis.

The object of the designer was to produce an instrument which, when attached to an engine, would give a continuous graphical record of the governor's action, which would give a diagram showing the rapidity of regulation, the promptness of adjustment and the stability under varying conditions.

The construction of the apparatus is shown in Fig. 1. A pantograph is attached to the engine bed at *B*; the opposite link is attached at its center, *D*, to the valve rod. The pencil which draws the diagram is placed in the end of the link, *E*, and lies in a straight

The valve travel decreases from 2.27 inches to 1.77 inches. The indicator cards Nos. 3a and 3b (Fig. 3) show the changes in the load. The diagram shows that the change in the governor's position was accomplished in four revolutions, or in about four-fifths of a second.

Diagram No. 5 (Fig. 2) shows the action of the governor in changing from light load to heavy load. The indicator diagrams 5a and 5b, Fig. 5, were taken before and after the load was thrown on. In this case the governor required five revolutions or about a second to accomplish the change. The wave in the diagram shows the oscillation of the governor before coming to rest.

LETTERS FROM PRACTICAL MEN.

Stamping Titles and Numbers on Drawings.

Editor American Machinist:

In my paper last year on "The Relation of the Drawing Office to the Shop," read before the American Society of Mechanical Engineers, I referred incidentally to a method of stamping titles and numbers on tracings so that they could be blue printed and give good results. I have received so many inquiries asking for information as to this that it may be of interest to your readers to state how it is done. It is well known

by those who have tried the experiment that it is difficult to obtain a satisfactory ink that can be used with stamps on tracing linen.

Stencils are unsatisfactory, as they are coarse and give broken letters and are not always black. Printers' ink will not answer because, although it gives a clean appearance, it does not dry on tracing linen and soon smears and rubs off. After some experimenting we obtained a special lithographic ink which, when used with the addition of a siccative or dryer, will give clean black impressions equal to type printing and will dry in a short time and be permanent. This result is obtained at the cost of some little care, but the results are good. We use metallic stamps of type metal or brass and removable type for the numbers. The ink is rubbed up on a palette each time it is used, and applied to the stamps by a composition roller similar to printers' ink, care being taken that only a small amount of ink is used.

After the impressions are made the stamps must be carefully cleaned each time with benzine, as the ink will soon dry and clog the stamps if this is not done. It is our practice to place the number and title in the lower right-hand corner of every tracing, and when a roll of tracing cloth is received it is cut up into standard sheets and all stamped and laid away flat in a drawer ready for use, the name of the drawing being filled in by hand in the blank space of the stamp. I inclose you herewith a sample impression of the stamps, and will be glad to send a sample to any of your readers who are interested in the matter.

The ink and stamps complete can be obtained from F. D. Hake, 450 East Water Street, Milwaukee, Wis.

A. W. ROBINSON,
Engineer Bucyrus Steam Shovel and Dredge Co.
South Milwaukee, Wis.

Making a Pattern for a Lamp Socket.

Editor American Machinist:

With this, I send you drawings of lamp socket and pattern for same. It will be recognized by some of your readers as used on top of the stand pipes along the railroads. There are at least two ways of making the pattern for the same, and my mode of procedure combines strength and quickness of construction.

We see by Fig. 1 that the socket must be molded in a three-part flask. Also, the "cap" being so thin, we have to do some thinking as to the best way of holding it in the lathe. Fig. 4 shows a block screwed on to a faceplate and projecting far enough for the operator to turn the back to the right curve. It will be noticed that the outside face is reduced, its diameter conforming to the straight part of the work. After facing off the block, and having glued up the work in three thicknesses of material, it is glued on to the block, as shown, with paper between, and when ready it is easy to remove it without injury, by inserting a chisel in the joint, thereby splitting the paper. It is best to put a concentric mark on the back before removing to enable one to find the center at the back for setting core print, also circle on the inside corresponding to the outside of the wings. The next step will be to work the ends of the wings to the shape required, and halving them together, as seen at Fig. 3 and lower view of Fig. 2. As both sets of wings are of the same width, a strip the right thickness and width can be planed up, long enough to make the whole, giving a slight draught. The "shaft" or rectangular center is formed by getting out a strip long enough to make the eight blocks, as seen at *a*, Fig. 2, planed to proper width and thickness, four of them projecting over the joints, and the others standing back just that much, which keeps the two parts of pattern in place without pins or dowels.

The core prints are glued and nailed in place in this case, there being extra draught given to same, to enable the sand to "lift" easy. Some molders would grumble and want them loose; and if they were larger, say, twice this size, it would be best to have them so.

The core box was made to form a "whole" core with the ends tapered to fit the prints.

I believe pattern makers sometimes shirk the latter part, and think the core maker can soon file to fit prints; but often we get holes cast anywhere but in the right place on that account.

WM. NEWTON.

Oneonta, N. Y.

The "Tight Joint" for Pipes.

Editor American Machinist:

An article which appeared in the November 21st issue, p. 925, has been brought to our attention. It describes an improved pipe joint, the invention of which is erroneously ascribed to Auguste J. Rossi. We beg to correct the error. The device described, which is known as the "Tight Joint," is the invention of C. A. Folly, and was patented June 2, 1891, and is manufactured solely by the Tight Joint Co., 159-161 Bank Street.

Auguste J. Rossi, B. S. C. E., made a report on our fittings which was published in the March, 1894, issue of *Ice and Refrigeration*, and which we afterward embodied in the enclosed pamphlet. We have received several letters from customers calling attention to your article.

We note in the closing sentence of the article that you express the opinion that these joints will not stand "expansion and contraction under changes of temperature."* Regarding this we beg to say that practical use and thorough tests have demonstrated that such is not the case, but that on the contrary the ability of the tight joint to remain tight under changes of temperature is one of its chief advantages. In the building of ice machines "expansion and contraction" heretofore has been one of the chief difficulties. During the very short time these fittings have been on the market we have sold about 40,000 fittings to the ice machine trade alone, and every fitting has met our guarantee, viz.: "Not to leak from expansion and contraction and to make a tight joint under all conditions and pres-ures." On this point we would call your attention to the enclosed copy of a test made of tight joint fittings by the Standard Oil Co. This test was made for the special purpose of determining the action of the fittings under excessive expansion and contraction. As a result of this test the Standard Oil Co. have adopted tight joint fittings for the refrigerating machines in their several paraffine works.

The Otis Elevator Co. have adopted our fittings for their new "high duty elevators," and on the two plants already erected, one at the American Tract Society Building, this city, and another at the Girard Life Building, Philadelphia, Pa., have used a large number of fittings, the complicated system of pipe and fittings being thoroughly tested to 2,500 pounds per square inch hydraulic pressure, and not one joint leaked.

TIGHT JOINT COMPANY.
DE WITT C. FLANAGAN,
New York. Vice-Pres. and Mgr.

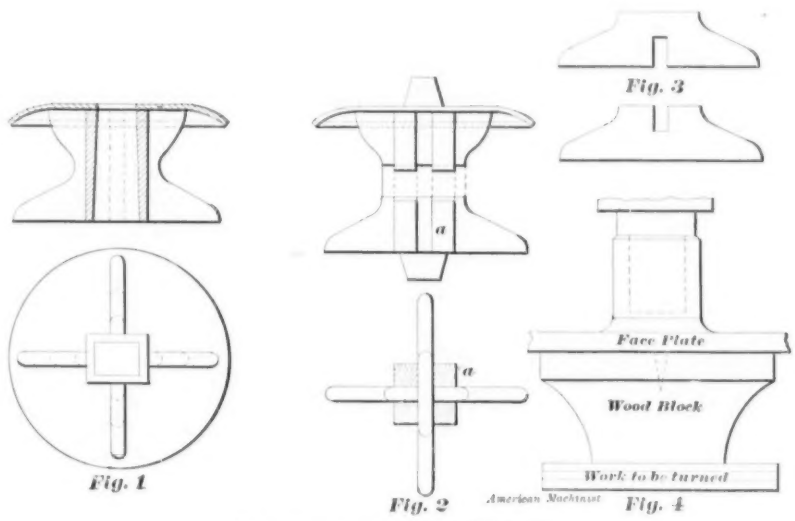
*We do not think our remarks can be fairly interpreted as such an expression of opinion.—ED.

Inventor of the Tight Pipe Joint.

Editor American Machinist:

In your issue of November 21st inst., I see that you credit me with the invention of a tight joint method for pipes under pressure. Though I consider the invention as valuable I have to decline the honor. I was consulted about a year ago as to the merits of the new system, and wrote in *Ice and Refrigeration* (N. S. Rich, Chicago, publishers) an article on the subject which, I understand, has been reprinted by the interested parties, "The Tight Joint Co.," which is manufacturing these fittings under the patent of Mr. Folly, who, by the way, did not show much *folly* in inventing this method.

AUGUSTE J. ROSSI.
35 Broadway, New York.



PATTERN FOR A LAMP BRACKET.

Cut-Off on Corliss Engines.

Editor American Machinist:

Many engineers or readers of your valuable paper may be misled by Mr. W. E. Crane's statement in your (October 7th) number about Corliss governors.

It is well known that a *single* eccentric Corliss "will not respond to its governor unless the cut-off takes place before ½ stroke." "But there are Corliss engines running that will respond to the governor for ¼ stroke," and the engines (Mr. Crane should have added) are double eccentrics, one each exclusively for exhaust and steam valves respectively.

FERRET.

San Cayetano, Cidra, Cuba.

[As Mr. Crane has been perhaps the most prominent advocate of double eccentric Corliss engines, he is probably familiar with the feature of the case mentioned by our correspondent.—ED.]

Differential Gears.

Editor American Machinist:

Mr. Hess, in your issue of November 21st, calls up my letter on the differential gear fallacy, and uses my name with great freedom so as to compel a reply from me, but he could not have half read the matter he criticises. He did not see the two points I made, and the point he did see was not in the letter at all.

He says that I condemned the differential gear for reducing speed, when in fact I did no such thing, and think it a very good device for that purpose in some situations. I have no doubt that the Pratt & Whitney Co. and other eminent firms named use it with judgment and due care to avoid its defects.

The objection I raised was that it was inefficient and of small durability for the purpose of reducing speed to secure the power due to that reduction. For the feed screw of a gear cutter, where the power opposed is small, it is all right. For applying electric power to run an engine lathe it is all wrong.

I also objected to its being used for humbugging our financial men. It is an Egyptian antiquity, but is being trotted out as something new and a chance for investment, and I could name names if I felt disposed to.

If Mr. Hess can point to a case of its use for any long time for the purpose of delivering power to any considerable amount, he will have something to say to the point. As it is, he has said nothing worth anything but the labor of correction.

GEORGE B. GRANT.

A Job of Shaft Work.

Editor American Machinist:

After three years at Smith & Black's, I went down nearer the river to the Marine Engine Works and offered them my valuable services, and for some unknown reason they were accepted.

They did marine repairs, but they consisted mostly of babbiting old boxes and putting in new stay bolts. The engine works part must have meant saw-mill engines, for that was the only kind I ever saw come in.

I had been there about a week when, about the middle of the forenoon, in came the boss. "Al," said he, "take the crosshead off the little planer and get a lot of planer bolts, a few lathe tools, and be at the steamer landing at one o'clock. Bring your supper with you, for you will have to stay all night." The boss was not the kind of a man to ask questions of, and if he had said to take the fly wheel of the engine with me, I should have obeyed without a question.

There was a good-sized steamer that ran from the foot of the street down the river to Bridgetown; it was a slow boat, and took about ten hours to make the trip each way. Well, I went to the landing as ordered, for I expected a "snap," and I got it, too, but not in the way I expected. The boss met me at the wharf (the boat had just got in) and took me down into the engine room and explained to me what was wanted. It seemed that when the boat was built there was quite a long distance between two of the bearings on the propeller shaft. Why it was so the builders of the craft only knew, but when they attempted to get any speed out of her the shaft would vibrate and tremble so there was no resource but to slow her down. Well, to make a long story short, we took and bolted the planer crosshead parallel with the shaft, and as soon as I was ready the engine was started up at a very slow speed, the boat being well moored to the wharf, and I turned an additional bearing on the shaft. As we had but two hours at each end of the trip to work in, it took me nearly a week to do it. When it came to polishing, we made a pair of wood clamps, and did the work while making the trips, but the speed was too great for turning. I have turned lots of shafting since then, but no more of that kind, if you please, for

A. P. PRESS.

Notice to American Inventors and Manufacturers of Magazine Breech-Loading Rifles.

The New York State Board of Examiners appointed to select an improved magazine breech-loading rifle for the National Guard of the State of New York, in accordance with the terms of Chapter 600 of the laws of 1895, hereby gives notice that it will on or before Tuesday, December 17, 1895, accept for examination and test, in compliance with the terms of said act, any magazine breech-loading rifle of American invention and manufacture, subject to such rules as may be prescribed in conformity with said act, due notice of which hereafter to be given. Said rifle may be delivered to the board or its representative at the office of the board, No. 17 Adams street, in the city of Brooklyn, N. Y., on or before the 17th of December next. Notice of the time of examination and test and the methods to be adopted will be made later. Guns offered for test must be shipped at owner's risk and expense, each in a wooden case with hinged lid fastened with two suitable padlocks of different combination, each lock to have two keys, the keys of one to be retained by the owner, the others to be delivered to the secretary of the board when the case is received by him; all cases containing guns to remain in the custody of the board of examiners and at its disposal until the examination and test shall have been completed. No gun will be received without satisfactory proof that it is of American invention and manufacture; and every applicant will be required to furnish reasonable guarantee of compliance with the conditions contemplated by the law and the regulations made in pursuance thereof.

ALBERT D. SHAW, Chairman,
ELIPHALET W. BLISS,
ROBERT H. THURSTON,
Board of Examiners.
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The Use of Reason as a Strike Preventive.

The fact that an industrial establishment whose president has recently been elected Governor of a great central State has never had a strike or serious labor disturbance in the thirty years or more of its existence is being commented upon, and it is significant that this immunity from such disturbance is being everywhere credited to the management, and that it is assumed that the men employed in the establishment are not materially different from other employes in similar establishments. This view of the matter is being taken by some of our contemporaries who, nevertheless, uniformly place the entire responsibility for strikes that actually occur upon the men and always insist upon it that there has been nothing in the conduct of the proprietors or managers to criticise.

We happen to know a good deal of the establishment which is being discussed. Its conduct has not been without its own peculiar difficulties but it is an example of the successful working of what the AMERICAN MACHINIST has always contended is the proper way to manage industrial establishments. Its proprietors and its superintendent have always been personally acquainted with a large proportion of its employes and have at all times been accessible to the humblest of them. No reasonable complaint has been unheeded, but, on the contrary, it is well understood that any question or difference that may arise can be discussed and reasoned about with a view to mutually satisfactory settlement.

It is of course true that differences have arisen—about the same in character and frequency as in most other shops; men have left because they thought they were ill-treated, and others have been discharged for various reasons; wages, both by the day and piece, have been reduced upon occasion, but there has never been that brutal disregard of the spirit and feelings of the men that too often is found elsewhere, and the men have always found upon investigation that other similar establishments offered no better terms for similar work, if as good. In short, the career of this shop has been an example of the application of the reasoning faculties to industrial problems.

A notable instance of this occurred some years ago when the proprietors of other similar establishments in the same town themselves brought on an utterly needless contest with a then powerful labor organization. The proprietors of the establishment in question were urged to join in this lockout and "crush the organization." They were wise enough to refuse and to say that if it ever became necessary for them to fight their men they might do it, but that so long as such a fight could be avoided they preferred to go on with their business and be at peace. Their men were rendering satisfactory service, and so long as they continued to do so they could be members of labor organizations or not, as they might choose, and no questions would be asked of them on that score. The fight was a long and bitter one, in which general public sentiment condemned the aggressors; it was the chief if not the sole cause of the utter collapse and ruin of three large establishments, and was of incalculable injury to the town in which they were located. Competent and disinterested observers declare that it was a calamity that was utterly needless, and that a little reason in place of brutality and hot-headed unreasonableness would certainly have avoided it. The one concern that was guided by reason and by plain business principles and common sense in this crisis, and thereby avoided trouble, was ultimately benefited by the disturbance—a concrete example of the difference between unreasonable and reasonable dealing with men exactly similar and employed upon exactly similar work.

We have always maintained that men who wear overalls and aprons are about the same kind of men as those who sit at desks in the office, and are influenced by much the same motives. Some very foolish and short-sighted men are to be found in both classes, but the large majority of both, particularly in machine building establishments, are amenable to reason, are capable of seeing something of both sides of a question, and can be successfully dealt with only when treated as sentient human beings, with the feelings and ambitions that naturally pertain to such human beings.

We do not pretend that trouble can always be certainly avoided by any method or rule of conduct whatever, but certainly if experience teaches anything it teaches those willing to learn that the reasoning faculties can be profitably used in labor disputes, or rather in preventing such disputes.

The Safe-Opening Operation.

Lieutenant Samuel Rodman, Jr., expert in high explosives, sends us a detailed account of how the test of a screw door safe, at Pullman, Ill., came to be made. It will be remembered that we gave an account of the work and showed how it was done; that some attempt was made to throw discredit upon the account, and that we thereupon invited the presentation of facts that would show the other side of the story, if there was one, and that our invitation was declined. The reason for this seems apparent when we read in Lieutenant Rodman's statement that the safe in question had been made to order with a view to special security and was warranted to be burglar proof for 24 hours. It was opened by Lieutenant Rodman, assisted by two expert mechanics, Messrs. W. C. Clark and P. F. King. The banker who owned the safe, with about thirty witnesses, remained in the building and in an adjoining if not the same room while the operations were going on, and the work was done in 2 hours and 57 minutes—strictly burglariously, *i. e.*, with such means and under such conditions as the modern skilful burglar can readily command. Lieutenant Rodman states that the evident reason our invitation to present facts on the other side was not accepted was that there are none, or that such a presentation would only have led to a further exposition of weakness.

We are interested in the mechanical features of the question mainly, and do not therefore feel warranted in taking space in which to set forth all the circumstances and history of the case fully. We have shown, in various articles, the methods by which we believe it is perfectly practicable for any skilled burglar to open *any* laminated safe, working under the conditions usually at command by burglars. The fact that the company which built the screw door safe in question has, since that time, acquired control of the business of the company which made the only safe that could not be so opened does not change the mechanical facts of the case in the least, but simply tends to confirm the accuracy and fairness of our account; though we think no further confirmation was needed, and we should have paid no further attention to the matter if we had not been accused of selling space in our reading columns—something which we do not do.

The Cost of Bolts and Rivets in Machine and Engineering Construction.

The cost of the above necessary articles of construction has little to do with the price of them. Whatever the price, or even if they were supplied to contractors without price, they would be still most costly. How costly they are, few have stopped to realize, on account of the necessity which compels their use. The thickness of a boiler shell of given material determines its strength, and if we could make the complete boiler, as, for instance, a soap bubble is made, of homogeneous material of the desired thickness, the strength would be subject to no deductions; but with our boilers made as we must now make them, the addition of rivet holes, with rivets to fill them, reduces the strength to say 60 per cent. of the unperforated material, and at the same time adds to the weight in laps and rivet heads, so that, weight for weight, the rivets practically double the material cost of the complete boiler. We are everywhere using in bridges and roof trusses the product of the rolling mill, and in this service, too, rivets and bolts increase at once the weight and the weakness of every structure. This necessity of making our work in pieces and fastening them together places us at an unspeakable disadvantage in competition with the methods of nature. Who could imagine a tree with the limbs bolted to the trunk, and the smaller branches then riveted on, and the leaves each attached with a pin or two? We might take a lesson from the tree in the matter of making each part exactly proportional to the work that it is to do. The idea upon which the one-hoss shay was built, of making "the weakest place as strong as the rest," while it is correct enough, can never be realized with our present materials and our methods of using them. What we really have to do now, in the way of saving material, or, what is really the most important thing in structural work, saving weight, is to make "all the rest" as weak as the weakest. The weakest is, of course, strong enough, and the parts that are not so weak are too strong or too heavy. As a rule all the products of the rolling mill, comprising as they do members of considerable length and of uniform cross-section, are objectionable in use because of the excess of weight and strength throughout the length, as compared with the parts upon them, which are weakened by bolt or rivet holes. This is certainly true, in any structure, of the members whose function is entirely tensile. If the end of a bar of any section is weakened by holes, then all the length of it within the holes may be reduced to the same strength. We have not often done this. There is probably no bridge of modern construction that might not have considerable of its metal cut away at various points without making it at those points weaker than the weakest. The practice of thus cutting away superfluous metal would be, of course, a costly one, and, generally speaking, cannot be seriously considered; but it is worth while to give vastly more attention to the production of forms of steel bars that are strengthened at necessary points for bolt and rivet holes, instead of being satisfied with the present cheap but costly product. There would seem to be a great field for invention in the line of producing forms of steel bars other than those of uniform section.

This problem would not exist if we could be assured that steel could be cast in molds, and be in every way as strong and reliable as forged material. In this direction, as our columns will testify, great progress has been made. Steel castings are now obtainable that show in test specimens remarkable excellence. Castings, of whatever material they may be made, have the great advantage that they may be strengthened as required at any point to compensate for the bolt holes that may be necessary, and they may be produced throughout of any shape, and with every part, after completion, "as strong as the rest." The recognition of this valuable property did not come all at once; the avoidance of bolts in construction by casting large frames in single pieces is a more or less modern practice.

Things may be too familiar to receive proper attention. We are aware that there is not the slightest novelty in the above line of suggestion, but it may still be not unprofitable to follow its leadings to points beyond those where we are accustomed to stray.

As our readers know, we are not much given to publishing photographs and do not do it unless there is some apparent reason for it.

We assume, however, that most of our readers will be interested in the physiognomy of a man who has been chosen to the highest position of honor connected with the art of machine construction, and, believing this, it is the present intention to publish a photograph and sketch of each newly elected President of the American Society of Mechanical Engineers. We inaugurate the custom this week with the portrait of a man who, in being honored by selection for the position, also honors the society by his

acceptance of it—a man whose fame as an engineer is world-wide and whose friends include all who know him, from the most obscure laborer in a great iron works to the most prominent men in private and government industrial establishments throughout the world.

Literary Notes.

THE ELECTRICAL TRANSMISSION OF ENERGY. A Manual for the Design of Electrical Circuits. By Arthur Vaughan Abbott, C. E., Chief Engineer Chicago Telephone Co.; Member American Society of Electrical Engineers; Member American Institute of Mining Engineers, Junior American Society of Civil Engineers.

This work deals principally with the scientific designing and proportioning of electrical circuits, and has been prepared chiefly from the aspect of the author's experience. Such methods of circuit construction are given in connection with tabulated data as have been sanctioned by the best practice, both in this country and in Europe. No attempt has been made to render the volume an encyclopedia, and therefore all matter obsolete or antiquated has been rejected, and only such is presented as seems to be fully warranted by the present state of the art. The book is liberally illustrated and contains many useful tables and valuable data, all arranged in a convenient form for the use of the electrical engineer.

The opening chapters are devoted to an outline of circuits, and to an annunciation of the principles and laws governing conductors and insulators. This is followed by a discussion of the methods of constructing aerial lines and description of underground conduits and conductors. The succeeding chapters treat on electrical instruments, methods of electrical measurement, continuous current conductors, conductors for alternating currents, series distribution, parallel distribution, miscellaneous methods of long distance transmission and the cost of production and distribution. This book will be very serviceable in the hands of an electrical engineer and form a valuable addition to his library. It is published by D. Van Nostrand Company, 23 Murray street, New York. Price, $4.50.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet. We cannot undertake to answer questions in "next issue." This department is usually crowded, and questions must wait their turn to be answered. Neither can we undertake to solve mechanical or engineering problems, and send answers by mail.

(425) H. E., Brooklyn, N. Y., writes: Inclosed please find two paper patterns for a funnel in regard to which there is a dispute; please decide which pattern is correct. *A.*—We cannot determine which pattern is correct without knowing the form of the funnel. It seems to us that both patterns are defective.

(426) H. G. C., Des Moines, Iowa, asks: Which is the proper way to order iron, studs, set-screws, etc., $\frac{7}{8}''$x2″ or 2″x$\frac{7}{8}''$, $\frac{7}{8}''$ being the diameter, and 2″ the length, and in flat iron should we say $\frac{1}{4}''$x$1\frac{1}{2}''$ or $1\frac{1}{2}''$x$\frac{1}{4}''$? *A.*—In ordering studs and screws we would always give the diameter first, and with flat iron we would give the larger dimension first. It is probable that this represents the most general but not the universal practice.

(427) P. C., Jersey City, N. J., asks: How much power is lost by friction in the thrust bearing of a modern steam vessel, and what would be the increase of velocity if a frictionless thrust bearing could be made? *A.*—The power lost by friction depends on the design of the thrust bearing and the lubricant used. We believe it is impossible to make a frictionless thrust bearing, and therefore no comparison can be made with such a bearing and those at present in use. The friction of the present thrust bearings will probably amount to not more than $\frac{1}{10}$ of the thrust if the bearing is well lubricated.

(428) A. H., Indianapolis, Ind., writes: I would like to inquire if you can provide me with any information regarding the erection of the Corliss engines, or if you can give me some references on the subject. I am interested in the erection of these and other engines and boilers, and the testing of steam plants, and will be much pleased with any information relating to the same which you may furnish. *A.*—No regular mode of procedure which will hold good for erecting all classes of engines can be given; each case will demand good judgment and experience. The method for setting the Corliss valve gear has been explained in our issue of May 16th, current volume. For testing steam boilers and engines you will find much useful information in the "Text-Book on Experimental Engineering," by R. C. Carpenter.

(429) D. L., Springfield, Ohio, asks: Is it practical to cut a thread upon each end of a cylindrical casting without first turning the scale off the part to be threaded? The part for the thread is about 3½ inches in diameter and 1 inch long, all the rest of the casting being smaller than the bottom of the thread. The thread is 10 to the inch, sharp V, and to be cut with a collapsing die. *A.*—We consider it decidedly unpractical, or impracticable, to cut the thread as proposed. The scale will injure the die, the casting will not be round, and it will not be of the exact size required. It is, in our experience, quite difficult to cut a sharp V thread upon cast-iron. The diameter of the piece to be cut should be a trifle smaller in all cases than that required for a full thread, and, therefore, the exact size is a matter of considerable importance.

(430) E. E. K., Dalton, Ga., writes: Kindly inform me of a cement which can be successfully used for rubber and leather belts; these will be subjected to moisture and hard usage, for instance, for portable saw mills, farm engines, etc. *A.*—For leather belts take of common glue and American isinglass equal parts; place them in a glue pot and add water sufficient to just cover the whole. Let it soak 10 hours, then bring the whole to a boiling heat, and add pure tannin until the whole appears like the white of an egg. Apply warm. Buff the grain of the leather where it is to be cemented; rub the joint surfaces solidly together, let it dry for a few hours, and the belt will be ready for use. For rubber belts take 16 parts gutta percha, 4 parts India rubber, 2 parts common caulker's pitch, 1 part linseed oil; melt together and use hot. This cement can also be used for leather.

(431) R. W., Columbus, Ohio, writes: Please inform me how to galvanize small castings. *A.*—Cleanse the castings so that they are free from sand, then heat one by one, plunging while hot in a liquid composed as follows: 10 pounds hydrochloric acid, and sufficient sheet zinc to make a saturated solution. In making this solution, when the evolution of gas has ceased, add muriate or preferably sulphate of ammonia, 1 pound, and let it stand until dissolved. The castings should be so hot that when dipped into this solution and instantly removed, they will immediately dry, leaving the surface crystallized like frost work on a window pane. Next plunge them while hot, but perfectly dry, into a bath of melted zinc, previously skimming the oxide on the surface away, and throwing thereon a small amount of powdered sal-ammoniac. If the articles are very small, inclose them in a wrought-iron basket on a pole and lower them into the metal. When this is done shake off the superfluous metal, and throw them in a vessel of water to prevent them from adhering when the zinc solidifies.

(432) W. G., Boston, Mass., writes: I wish to determine the safe load which can be supported by two parallel overhanging rolled steel Carnegie I-beams bolted together, of the following dimensions: Depth, 7 inches; thickness of web, .23 inch; width of flange, 4 inches; weight per foot, 15½ pounds. The load is placed at the end of the overhanging part at 3 feet from the support; the other portions of the I-beams are well supported above and below. I should be greatly obliged for a solution of this question. *A.*—Here we have simply two cantilevers loaded at the end three feet from the support. The rule for finding the weight in pounds of the load which each cantilever can support is as follows: Multiply the safe working stress by the moment of inertia of the section of the beam and divide the product by the length in inches of beam (or the distance from the support to the center of the load) and by one-half the depth in inches of the beam. In symbols we have:

$$\frac{S \times I}{l \times c} = W; \qquad (1)$$

in which S = safe working stress in pounds per square inch, I = moment of inertia, l = distance in inches from the support to the center of load, c = half the depth of the beam, and W = weight in pounds of the load. Now, if you will look in the "Pocket Companion," issued by Carnegie, Phipps & Co., you will find the numerical value of the moment of inertia for this particular section of beam to be 38.6. For the safe working stress we may take 12,000 pounds per square inch. Now, substituting for the symbols in formula (1) their values, we have

$$\frac{12{,}000 \times 38.6}{36 \times 3.5} = W = 3{,}676 \text{ pounds}$$

for each beam, hence the two beams can support a load of 3,676 × 2 = 7,352 pounds.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 972.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Engrs. should investigate the Korting Condenser. Obtain Catalog from A. Aller, 109 Liberty St., N. Y.

Marine Iron Works, Chicago, builders of steam yachts and marine machinery; catalogs free.

Best Presses and Dies for all sheet metal work, Ferracute Machine Company, Bridgeton, N. J.

Just issued—Catalog No. 8. Mailed Free. Clayton Air Compressor Works, 28 Cortlandt St., New York.

Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N.Y.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

Key Seaters for any length of hub or width of keyway. New, handy machines. Mitts & Merrill, 913 Tilden Street, Saginaw, Mich.

A book for superintendents. "Hawkins' Calculations" (descriptive), $2.50 postpaid. Catalog free. Theo. Audel & Co., 91 Liberty Street, N. Y.

Thin emery wheels, for cutting slots, etc., a specialty. The Tanite Co., Stroudsburg, Pa.; 161 Washington Street, New York; 139 East Pearl Street, Cincinnati, Ohio.

"Practical Drawing," by J. G. A. Meyer; used by engineering schools in lieu of text-book; the set of 92 papers sent to any address in the United States for $5. AMERICAN MACHINIST, 203 Broadway.

Heat Insulation.*

The insulation of heat is an important function in the economy of nature, and a constant question in the operations of men. We live between two non-conductors, the air and the earth, and we could not live were these elements devoid of that property. Earth is a good non-conductor and the vegetable growths which cover it are better. Land animals are clothed with the best non-conductors that are known. Man is the only being for whom nature has not provided heat insulating clothing. Man has appropriated the heat insulators of animal and vegetable growth for his clothing and secured health and comfort thereby. In buildings, the heat insulation has been largely overlooked. It is practicable and economical to so construct houses that extremes may be avoided both in summer and in winter. The principal artificial non-conductors are asbestos fiber, mineral wool, pure infusorial earth, lime, magnesia, wood pulp and others. Architects should demand insulating brick for inner walls, non-conducting plastering and proper windows, and they may easily be furnished, while mineral wool filling is very efficient in frame houses.

For low temperature work, such as preventing water pipes from freezing, or insulating ammonia pipes, etc., in refrigerating plants, materials made of animal or vegetable fibers are generally better than mineral substances. This service is growing in importance as refrigerating plants are rapidly increasing. The service desired in this line of insulation is peculiar to it. The prevention of the passage of heat in either direction is not the prime object. Cold pipes in warm rooms condense water from the atmosphere and drip, and the purpose is to overcome this. Air is to be excluded from the cold surface and a surface must be produced that will not be cold enough to condense water from the atmosphere. An air-tight sheathing must be provided, and between the sheathing and the cold body sufficient insulation to keep the air-tight sheathing at nearly the atmospheric temperature. Hair felt or wool felt, with a resinous air-tight sheathing, are efficient for this purpose.

The function of heat insulators on boilers, pipes, etc., is simply to provide clothing analogous to what we wear; and the first insulation of steam pipes was by wrapping with cloth or paper. Insulation at high temperatures is imperative as the loss of heat by radiation increases with the temperature. Where a square foot of surface at blood heat will radiate 1¼ heat units, at red heat it will radiate 300, and at white heat it will radiate 4,604 units. Coverings are almost as much needed in summer as in winter.

Animal or vegetable fibers applied for insulating steam pipes and such purposes were soon charred and destroyed, then mineral substances alone, such as lime clay, etc., were tried without success, and after that the mixing of hair and vegetable substances with those minerals was resorted to. This was a great improvement, but still the fiber would burn out, and then asbestos was tried, half a hundred or more patents being taken out in this country for asbestos cements. An air space inside the cement was tried and increased its durability, but the air is not as good a non-conductor as generally supposed, one inch of air being to an inch of hair felt in non-conductivity as thirteen to one hundred.

Most of the coverings now being made by reputable manufacturers are good non-conductors, and the most important question is as to their permanency. Experiments in the engineering departments of a number of our leading colleges as to the heat insulating power of different classes of coverings have led to very conflicting results. At the University of Michigan, under Professor Cooley, the test showed in favor of hair felt. At the Pennsylvania State College, mineral wool was shown to be the best non-conductor, and the writer was informed that at Cornell University wool felt lined with asbestos paper appeared in a favorable light. In some of the tests asbestos coverings came out ahead and magnesia in others. The writer's experiments have shown that different pipes, all insulated with the same material, will at times show, by condensation tests, almost as varied results as the college tests have shown in pipes covered with different materials. Coverings can be made either of hair, wool, asbestos, wood pulp, mineral wool, infusorial earth, carbonate of magnesia, chalk, gypsum, and compounds of those and other materials, that will be so nearly alike in non-conducting power that a slight change of condition will turn the scale for or against either. While there is a question as to which will save a few heat units more than another, there is no question as to the great difference between a bare boiler and one that is covered. The relative conducting power of equal surfaces of four different materials is given as follows:

Chalk	1
Ordinary stone	15
Iron	268
Copper	593

Chalk is here purposely used in illustration because it is very similar to the three materials most largely used in combination with asbestos in making high temperature coverings—these are infusorial earth, carbonate of magnesia, and gypsum, each largely dependent for its strength upon the asbestos incorporated with it.

Porosity is one of the properties of a good non-conductor and this tends to weakness, hence clothing for steam pipes is apt to wear out like other clothing, and means to counteract this and make coverings permanent is now the one thing needed. The writer is thoroughly convinced that to reinforce them with iron is the only way. Iron can be so incorporated in the body of the covering that the air cannot reach it, and then its life is practically unlimited, and it in turn will hold the covering in place indefinitely. The writer, although knowing this fact for some time, has been unable to introduce it to the public on account of the cost. If the price is increased to cover this improvement

* Abstract of a paper by John A. McConnell, read before the Engineers' Society of Western Pennsylvania.

others get the contract, although the paying of the additional cost is the very best economy, for coverings strengthened with iron will last five or six times as long as any of the coverings in general use.

A high degree of permanency is attained by using one inch thick of any of the well-known mineral coverings, and outside of this from a half inch to an inch of wool felt paper, made into solid tubes and securely fastened over the mineral coverings. Felt paper coverings have failed of permanency because placed so near the pipes they would gradually burn up. With an inch of good mineral insulation next to the pipe, this charring of the felt paper is entirely overcome; and the paper coverings being very strong will, if properly fastened, hold the magnesia, asbestos, or other mineral covering in place two or three times as long as it would otherwise remain.

Less than an inch of mineral under the paper will not protect it, hence this plan means substantially two coverings and adds materially to the cost, and I do not believe it is possible to make heat insulating coverings permanent without making the first cost more than it has heretofore been; but by increasing the cost they can be made permanent.

Steel, Fire and Water.

By B. F. SPALDING.

RE-ENFORCING THE HARDENING CAPACITY WITH CYANOGEN.

There is that in every proper name which conveys some idea of the thing to which it is applied. One of the names by which hardenable iron is called is derived from a word which signifies an edge.

Steel is pre-eminently the material on which an edge may be maintained, or which will retain an edge. It does this by virtue of its combination of two qualities—hardness and toughness. I do not think that the terms hardness and brittleness need to be conjoined. These qualities are not necessarily bound together. It is not inevitable that a thing shall be brittle because it is hard, and good steel may be hard and tough. Material which is not hard may be brought to an edge. I have sharpened a piece of common sheet tin, which, in fact, was soft sheet iron, to so fine an edge that it would shave the thin hirsute growth from a boy's arm. I have done the same with soft sheet copper, and the same with soft sheet zinc.

All of these things proved to have the capacity of taking an edge, but they lacked the power to retain it. A criterion of the excellence of steel is the degree of hardness it may possess, and yet remain tough enough to retain the capacity of being brought to a fine, thin edge. If it is not very tough the microscopic edge will crumble, and if it is brittle the edge will crumble before it gets to be at all microscopic. One of the most beneficent uses to which steel is put is when it is employed in the form of surgical instruments, and then its main excellence is its power of receiving and retaining a keen edge.

Some steel workmen object to using cyanide of potassium, ferrocyanide, ferricyanide, and chromate of potassium, or any other "chemical," because of the fear of being misled by the surface hardness which may be produced at a low heat by their use. There are good steel workmen who, having been cheated in this manner, have adopted the theory that the use of these things actually has a pernicious influence upon the natural hardening capacity of the steel, and believe that if it is coated with cyanide it will not harden as deep as it would without it at the same heat. This is the lesson as they have learned it from their own experience, and what a man finds out by his own experience he is quite justified in holding to; in fact, he would not be justified in pursuing any other course.

Right here, while I think of it, I want to remind them that oxygen is one of the most deadly enemies to steel, and that potash is the best thing in the world to steal it away, for oxygen esteems it as its greatest friend, and has the strongest affinity for it of any known substance.

I have found many men, who delight in their calling as workers of the best metal known to mankind, who look with contempt upon the use of any chemicals in hardening steel, and want nothing for this purpose but fire and water—a clean charcoal fire and pure water. If they cannot produce the desired effects with these ancient elements upon the steel which is given them, they will have none of it, but insist upon having steel which the orthodox method of procedure will act upon in a regular and proper manner. They will use any steel, under protest—some will—but refuse to accept any responsibility for its conduct.

These men are right, I think, and yet, as they are generally held accountable in spite of their protests, I do not hold it a heresy to use cyanide if there is reason to suppose it will be beneficial, and perhaps some of them will agree that such may be the case if they will examine the nature of the materials with me and trace their probable effects. I will state the reasons for my belief, because it is beyond doubt that we need the assistance of every material which promises advantage in the ticklish process of hardening and suddenly contracting a metal which is so sensitive as steel.

Pure water itself is not readily obtained. I doubt if pure water is often available, and if it was it might not retain its purity, under ordinary circumstances, long enough to be of practical value. Rain water, dropped directly from the heavens to man, contains impure traces of his presence. In passing through the air it is contaminated with smoke and dust and volatilized impurities of many kinds.

Thawed ice is nearly pure water, although it may have been frozen sea water. But not every one can keep an iceberg on draught, and the water which is usually available is little better than a slush of impurities, weak whitewash, herb tea, brown ink, soda, pop, and small beer as lime, sulphate of iron, carbonic acid, or organic matter may happen to be present.

What living chance does the raw steel, its fibers quivering with the vibrations of heat, have in such a mess? Purified by fire and naked, it shrinks from the unclean touch. No wonder it frequently repels such water, fights shy of it, rejects it in spots, perhaps, and so hardens unevenly.

It is an old tradition that the longer water is used to harden in, the better it will harden; just as though it learned to take hold and shove its coldness into the steel a good bit quicker after it got used to the way of doing it. Stale, standing water, let it be ever so carefully covered, is liable, however, to gather a dusty, grimy, somewhat tenacious scum on the surface. Into such water I have inserted a piece of half-inch hot steel as much as three inches deep before the film broke and let the water to contact, and the piece did not harden. Now, if the piece had been coated with any fluid substance, like cyanide melted on it, it would have taken its water at once penetrating the film. To test the effect easily, try a piece of steel in soap suds without cyanide, and then with it, and note the different manner in which it is affected.

One of the expedients adopted for overcoming the effects of those substances in water which prevent its attacking the steel is to overwhelm them by making the cooling medium strong in something which is positive in its aggressiveness. Hence the use of salt or sulphuric acid to make a brine or pickle which will attack the hot metal and get into such close contact as to quickly abstract its heat. Water under ordinary conditions boils at a temperature of 212° Fahr., but well filtered water contained in a perfectly smooth vessel, standing perfectly still, may be brought in the open air to a temperature of 230° Fahr. without boiling. Water freezes at 32° Fahr., but in a smooth dish, if perfectly undisturbed, it may be cooled several degrees below this point without freezing. Now, upon a slight agitation of these two vessels the water in one will burst into violent ebulition, while in the other it will immediately congeal. Success in hardening often depends, like the excellence of chronometers, upon the movement. Amateurs who have made careful study of the dangers and difficulties of putting a piece of steel into the water straight, and taking it out straight, have sometimes failed to give it sufficient motion to insure hardening.

By moving the piece around in a small circle, every part is brought successively to front the water, and theory tells that the effect is to warp in every direction, and warp back again. In practice, permanent set may be guarded against by rapidity of movement in a small circle, for change of structure requires time for its manifestation.

When the water for quenching rises in the vessel from below, its volume, however slow its motion, should be so large that the piece to be hardened will probably be exposed to an equal flux on all sides over the full length which is to be hardened.

In a recent periodical, a writer, who shows a thorough and intimate acquaintance with his subject, states that the fact that crucible steel is better than Bessemer or open hearth is owing to some discoverable and removable cause; and expresses his opinion to the effect that "it is almost certain that it is due to an excess of oxygen, nitrogen, or hydrogen, or of all of them, either as elements or combined in the form of oxides, cyanogen, or ammonia, all of which are introduced in steel in the Bessemer and open hearth processes in much greater quantities than in the crucible process."

While the writer affirms that the difference in these steels is "not due to ghosts," we may yet remember that "the Germans, in their peculiar vein of sarcastic playfulness upon the popular superstition which held that the noxious exhalations fire damp or choke damp were the guardians of the mineral treasures of the old earth, gave them the name of 'gases,' or 'ghosts,' which became common in time to all aeriform fluids," and so, looking at it in this good old way, we may yet remain believers in the weird faith that the reason why Bessemer and open hearth steels are not as good as crucible steel is simply because they are haunted by the ghosts, or gases, which have come into them in the process of making. The task of the metallurgist is to exorcise these demons with book and bell. If he will do this, he will have better steel than even crucible steel, for, if we may judge by its behavior, there is yet found occasionally some imported crucible steel from which these bogies have not been thoroughly evicted.

It has been noticed by a number of investigators that when charcoal saturated with carbonate of potassium is heated to whiteness in a current of nitrogen, cyanide of potassium is produced, and large sums of money have vainly been spent in the attempt to make the nitrogen of the air combine with carbon to form the cyanogen of the ferrocyanide or yellow prussiate of potash. The source still depended upon is animal matter. It has to go through protean change, and appear in the gaseous, vegetable and animal shapes, before it is crystallized in the desired form. The kind of animal matter employed and the amount of nitrogen in each kind, is given in the following table:

	Per Cent. Nitrogen.
Horns and hoofs	14 to 16
Dried blood	14 to 16
Wool and hair clippings	10 to 16
Feathers	15 to 17
Leather parings	6 to 8

Cyanide of potassium contains nothing which can injure steel, if it is pure, and its freedom from impurities is assured by the purity of the ferrocyanide of commerce, which is usually so good that samples, taken at random, test to within less than one-fourth of one per cent. of absolute purity. The ferrocyanide is made by taking enough of any of the materials named in the above table to furnish 16 pounds of nitrogen, which would be 100 pounds of horns and hoofs, or 200 pounds of leather; 80 pounds of carbonate of potash is melted in a covered pot, the other material is stirred into it, a few pounds at a time. This makes the "melt," which, when cool, is dissolved in water, filtered, crystallized from the solution into the yellow prussiate or ferrocyanide. To make the cyanide, 10 parts of this are melted, in an iron pot, at a low red heat, with 3¼ parts of carbonate of potassium. The product is 8 8 parts cyanide and 2.2 parts cyanate (the cyanate contains oxygen). When a sample taken out on an iron rod solidifies in an opaque white mass, the clear portion is poured into a mold. Varieties are made in which the proportions of carbonate and cyanide differ, one 90, one 70, and one 50 per cent. cyanide. That which has the largest per cent. of cyanide is probably best for hardening.

We have become so familiar by hearsay with the process of converting iron into steel by packing it in charcoal and subjecting it to long continued heat that we do not inquire of the crucible steel melters whether they use "chemicals" or not. We take it for granted that they impregnate iron with carbon by gradual absorption, and that charcoal furnishes the hardening principle; and it does not seem probable that prussiate or cyanide will do the same thing much more readily—that it is, in fact, the crystallized steel principle, the carbon and nitrogen concentrated.

There is no mysticism about charcoal from wood, bones, or leather, but these chemicals—ah! they come from the drug store—look too much like doctoring; drugs are brought from far, are uncanny, out of nature, mysteries of alchemy. Pshaw! the cock on the dunghill, or the cat on the back fence, furnish all the material for cyanide of potassium. Burn the fence, leach the ashes, get the lye, boil it down into carbonate of potash, skin the cat and throw her hide and hair into the pot, raise the mass to a red heat, and there you are. Have some order about it, go by rule, neatly and systematically, and the result will be as nice, pure, white cyanide as ever was made—pure essence of steel.

How does carbon creep down into the structure of iron? Some railroad rails made from Dank's machine-puddled iron were case-hardened (before Harvey's patent), and the carbonization was found to extend inward for a quarter of an inch, and the percentage of carbon in each successive sixteenth of an inch is given. The average of seven specimens in the first sixteenth was 0.862, in the second sixteenth 0.496, in the third 0.253, in the fourth it tapered from the 0.253 to nothing. The second carbonized more than half as much as the sixteenth exposed on the surface, and the third more than half as much as the second.

It is possible that these proportionate parts might hold good for any given depth to which the carbonization might extend, that is, the first fourth of the whole depth, twice as much as the second, etc., but probably these proportions would vary with many varying circumstances.

If a mere surface or skin hardening is all that can be effected by the use of chemicals, I would not set a very high value upon them, for when there is an abrupt difference in the hardness and tension of the outer and inner portions, there is, at every thermal change, a difference in the rate of expansion and contraction of such portions, with a tendency to injurious strains and a susceptibility to fracture. But if used in the right way they will facilitate the changes in the constituents of the steel which take place in hardening, and affect the structure to a greater extent than would otherwise occur.

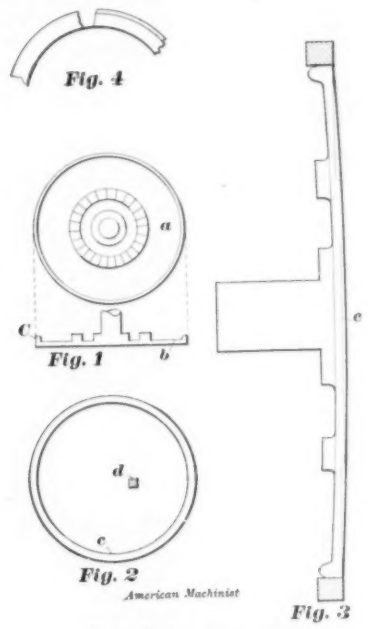
How does the cyanide affect the steel, and how does it make the steel harden any better by its presence? It can do this in two ways. First, it can afford a more ready medium through which the heat can reach the water, and secondly, it can communicate to the hot metal some chemical properties which endow it with a greater capacity for hardening.

There has been erected at Rockville, Conn., the largest iron smokestack in New England. It is 100 feet high, 54 inches in diameter, and weighs 10 tons.

A Cast-Iron Surprise—Hanging a Door by the Calculus.

BY JAMES F. HOBART.

Some queer things turn up in a blacksmith shop once in a while, and the one illustrated by Figs. 1 to 4 may well be classed with "the unexpected which frequently happens." Fig. 1 represents the ink table or disk to an ordinary job printing press. It

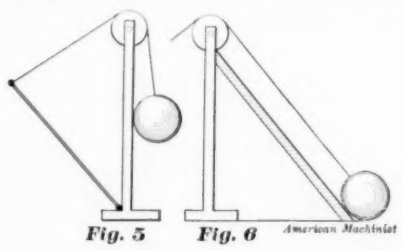


CAST-IRON SURPRISE.

is shown in plan at *a* and in section at *b*. It will be noted that the outer edge *c* takes the form of a slight web projecting to one side only. The thickness of plate through the web is about $\frac{1}{4}$ of an inch, through the main part of the plate at *b* about $\frac{3}{16}$ of an inch. For some reason or other the ink plate was made too small, so that it did not give the proper distribution at the ends of the rollers. It was proposed to shrink an iron ring upon this disk, the ring being made $\frac{1}{2}$ an inch square in section, as shown at *d*, Fig. 2.

The ring was heated up as shown at *e*, nicely rounded and its diameter measured as accurately as possible, the smith giving it about $\frac{1}{16}$ less diameter than that of the disk. It was heated moderately hot and shrunk upon the disk, going easily over the edge when just barely above a dull red heat. Upon cooling the disk, the smith found to his surprise that it was badly sprung, as shown at *e*, Fig. 3, the central portion projecting fully $\frac{1}{4}$ of an inch, rendering the plate useless for the purpose for which it was intended. Not daring to re-heat the ring, the job was taken to a machinist who cut the ring in two with a hack saw, as shown in Fig. 4, whereupon it immediately jumped open about $\frac{1}{2}$ an inch, with a report like that of a pistol. The ring was again welded and stretched until it was apparently of the same diameter as the disk. To make sure, a wheel was run around the outside of the disk, and over the inside of the ring. The ring showed a circumference of about $\frac{1}{8}$ of an inch less than that of the disk. This was judged to be too much, and the ring was pened until the wheel showed the same distance around both. Upon again shrinking the ring on, the disk did not bulge as much as before, but it sprung out over $\frac{1}{16}$ of an inch.

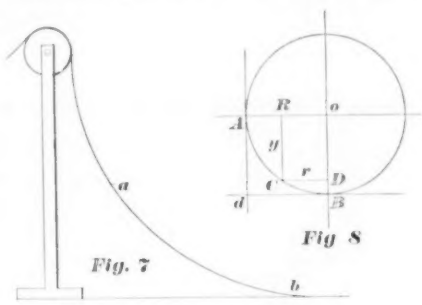
The question arises, what became of the metal in the rim of the disk when the iron band pressed so hard as to cause the center

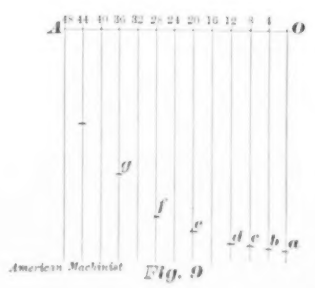


of the disk to bulge; is cast-iron as compressible as indicated by these phenomena?

A certain trap door in a certain shop gave considerable trouble to the workmen who frequently had to pass through it. A horizontal trap door in a passageway is a mean thing at best. The arrangement shown by Fig. 5 consisted of a heavy 2-inch door about 8 feet long and 4 feet wide. To pass through, the workmen must raise the door to a horizontal position. This arrangement naturally did not exist long before some one applied a weight and ball, as shown in Fig. 5. This assisted in a certain degree, but the ball had to be so heavy in order to balance the door when horizontal that it would raise the door and slam it against the upright post as soon as it had been started from the horizontal position.

After considerable thinking, it was decided to re-hang the weight in such a manner that it would bear in all parts of its travel just hard enough to counterbalance the door. It was then necessary to use a weight heavy enough to counterbalance the door when in a horizontal position and to remove part of the weight, as the door ascended, and all of the weight when the door reached a vertical position against the post. This was approximated by arranging a board for the weight to run upon, as shown in Fig. 6, the weight hanging vertically and exerting its full power when starting from the top. Upon arriving at the bottom the weight had traveled a considerable distance horizontally, and consequently could not pull as hard upon the rope as when it was suspended vertically at the top of the post. This was a help, but it did not give satisfaction. It was evident that a more refined method of distributing the weight was necessary. To this end it was determined to curve the track upon which the weight ran down. An approximation of this curve is shown in Fig. 7 at *a*. Here the weight exerted its full power at the top of the travel, and rested upon the floor at the bottom, certainly giving no power. At the center of





its movement *a*, it was moving in a direction of about 45 degrees from the perpendicular, therefore exerting about half its power. It is evident that the weight must equal about half the weight of the door, placed on a certain increment to allow for friction of the weight against the curve support and against the friction of the cord on the trolley.

How to lay out such a curve was a puzzler to the machinist for quite a while. He spent considerable time in looking up his geometry and trigonometry, also taking a look in the calculus, where he found something which helped him out. There he ran up against the well-known formula that the radius of any circle $R^2 = x^2 + y^2$, or, as shown in Fig. 8, the distance $A\ o = R$, $C\ R = y$ and $C\ D = x$. He also found that letters didn't mean just the same as they did in algebra, that x and y could and did vary in value, according to the location of the lines $C\ R$ and $C\ D$. But to find the value of either x or y, and consequently the location of points in the curve $A\ C\ B$ along its entire length, it was only necessary to assume lengths for x and find those of y, by the simple formula $x^2 + y^2 = R^2$.

This is done as follows: The line $A\ O$ is divided into any number of equal parts, and the length of one of these parts is x. This is shown by Fig. 9, where the distance $A\ O$ is divided by ordinates into 12 spaces, presumably of 4 inches each. Then the vertical lengths, one on each ordinate, were found by assuming that:

When $x = 0$, $y = 48$,

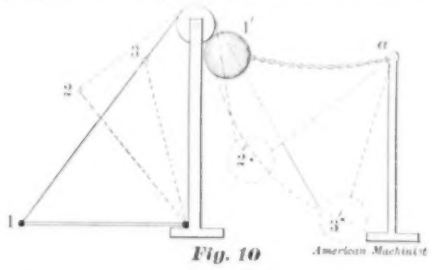
When $x = 4$, $y = 47.8$, as follows:

$$x^2 = R^2 - y^2$$

$$y = \sqrt{R^2 - x^2} = \sqrt{48^2 - 16^2} = 47.8.$$

Also, when $x = 8$, $y = 47.3$,
when $x = 12$, $y = 46.4$,
when $x = 20$, $y = 43.6$,
when $x = 32$, $y = 35.07$, etc.

Laying off these distances upon the corresponding lines in Fig. 9, the points *a*, *b*, *c*, *d*, *e*, *f*, *g*, etc., are obtained, which form, when connected, the curve the weight should travel to give the desired balance to the swing door. A plank foundation was built,



laid out as above, and carefully cut to the marks, then a little "trolley carriage" was arranged to carry the weight with as little friction as possible, but it was necessary to lower the track a few inches at *b*, Fig. 7, to counteract the effects of friction.

After the apparatus was put together it worked nicely. The door would stand counterbalanced at any point, and beyond getting the "trolley" off the track occasionally when the door was suddenly slammed shut, the device worked very well.

But the maker, after proudly showing the device to everybody who came along, and learnedly stating that, "This door was hung by calculus," had the conceit rudely shaken out of him by Uncle Peter, who, after looking at the rig, quietly chalked out Fig. 10 on the floor, and remarked: "Why in thunder didn't you have the weight at *a*, with a bit of chain, and get rid of the trolley, the plank run, the calculus, and friction, too?"

Machinery Destroyed in Russia.

A press dispatch dated St. Petersburg, November 24th, says:

The introduction of machinery in La Ferme cigarette factory led to a serious riot Saturday. The employes, who believed that the use of machinery would throw many of them out of work, smashed the machines and hurled the fragments out of the windows. They also threw a large quantity of cigarettes and unmanufactured tobacco into the streets. The police, aided by firemen, and headed by the prefects, suppressed the riot and arrested a great number of the employes and their sympathizers, who aided them in the demolition of the machinery and the destruction of other property.

American Machinery in Sierra Leone.

Mr. Robert P. Pooley, American Consul at Freetown, Sierra Leone, has made a report to the State Department, from advance sheets of which we extract the final paragraph, as follows:

There seems to be a probability that in the near future Sierra Leone may become a fairly good customer for American agricultural implements, machinery for hulling coffee and rice, cleaning cotton, and crushing palm kernels; also, other labor-saving machinery, as industries become more developed and the primitive means of transportation—canoe and head load—are superseded by the iron horse and the steam launch.

It is now announced that the World's Fair medals are about ready for distribution, but exhibitors will not receive them until diplomas are also ready, which will not be before February, 1896, it is thought.

The Machinist and the Theater.

A well-appointed theater usually has upon its staff a "machinist," but what he ever finds to do—and does—on machinist lines is a mystery, for it is rarely that anything involving machinery is employed upon the stage, and when anything beyond the simplest and crudest devices of the toy shop are employed there is no cause for congratulation. This is rather to be wondered at, as the work of the machinist asserts itself in every other walk of life, and it would seem that here also he should be working his wonders to the gratification of the sight-seers. There should be a great field for the use of creditable mechanical devices and inventions applicable to spectacular effects, but all attempts to occupy it have heretofore had in them more of failure than of success. Scenes that employ real water upon the stage are usually absurdly ineffective, and the scantiness of the flow has probably more to do with this than anything else. With a powerful centrifugal pump, an electric motor and a wire attached at the street corner, we should be able to secure much more impressive effects in this line than have yet been realized.

We remember a play in which the action of one scene took place upon a railway car supposed to be running at full speed. The wheels were seen steadily whirling around, the various train noises were quite well imitated, an unfortunate passenger who fell upon the track was suddenly swished to the rear and out of sight, and altogether the illusion of the scene was well sustained. A more daring mechanical attempt was in a play which has had a run extending over a number of years, in which several horses run upon a moving platform in simulation of a horse race. The platform, which runs in this case at right angles or across the stage, is simply an adaptation of the familiar agricultural or wood-sawing horse-power. In connection with it fences and scenery are made to traverse the stage in the opposite direction, and help to promote the illusion of motion, but after all it is difficult to see any mechanical invention involved, and the skill and care required for the successful action of the scene must depend more upon the training of the horses than upon anything else.

When scenes of this character occur to the managerial mind it may be well to know the limitations of illusive effects, and not to attempt the impossible. In a recent or current production the moving platform idea is given a more pretentious presentation. A platform flush with the stage floor is provided, extending the whole width of a wide stage and moving directly backward from the audience. The smoothness of movement and comparative noiselessness of the platform are mechanically quite creditable. The curtain rises with this platform in motion, and upon it two teams of four horses each, supposed to be drawing chariots, are running at considerable speed. The motion of the platform soon ceases, and the running of the horses comes to an end quite suddenly. While the horses are running they, of course, do not advance toward the audience, there is no retrocession of scenery attempted, or apparently possible, the imagination cannot fabricate any illusion of advancing flight, the scene can only be characterized as a childish absurdity. We hope to see the machinist do much better than this, and it should be before long.

Machine Typesetting.

In a typesetting match held in Chicago on the 24th ult. Geo. W. Green set 78,700 ems of matter in seven hours on a Linotype machine. With all corrections made, and imperfect lines thrown out there was 70,700 ems net.

It is said that there have been indications that Andrew Carnegie is thinking of following the example of Mr. Tom L. Johnson, in establishing a metallurgical industry on the shore of Lake Erie, in the vicinity of Cleveland.

A Fatal Steam-Pipe Accident.

A serious accident occurred in this city on November 26th at The Olympia, a new place of amusement which was first opened to the public the evening before. The accident was in the middle of the forenoon and consisted in the rupture of a cast-iron elbow in a six-inch steam pipe connected to the electric light engine. The casting seems to have been rather thin, proper provision was not made for the expansion strain in the pipe, and the rush of condensed water contributed to the catastrophe. Two men were killed and a number were seriously scalded. The accident revealed the strange fact that, either through a defect in the law or in its interpretation, the steam boiler inspectors, a part of the police system of the city, are not responsible for the condition of steam piping and connections. In these days of bursting steam pipes and fly wheels it would seem that they are as proper subjects of inspection as the boilers.

Mr. Camillo Olivetti, an engineer and a manufacturer of electrical instruments in Ivrea, Italy—a man who reads the American Machinist and keeps himself informed regarding American practice—is here looking up the matter of American agencies in his country and to buy tools and other machines.

The Bethlehem Iron Company, of Bethlehem, Pennsylvania, received word from St. Petersburg on the 25th that the company has been awarded the contract for 1,200 tons of armor plate for the new Russian battleship "Rostislav." The contract represents $600,000, and will keep the ordnance works, employing 2,000 skilled workmen, busy during the winter.

COMMERCIAL REVIEW.

New York, Friday Evening, Nov. 29.

The Machinery Trade.

A member of one of the best known machinery firms of this city states that the inquiry for tools and the tone of the market is slightly improving, this view being taken independently of the fact that his firm happened this week to receive one or two large orders that have been for some time hanging fire.

Railroad machine tools are doing well, and their sale will increase with better earnings of the roads. Small lathes, large drills and turret machines are still rapidly selling for bicycle manufacture. One party speaks of this as especially true of the Chicago market, and alludes to the favorable fact that buyers seem now inclined to place orders only where tools are in stock.

In twist drills there is a generally good trade with a tendency toward better prices. One company has noticed a little slackening of demand during the last month; but a gentleman who has just returned from a tour of other cities, where he has had opportunity to investigate the situation, speaks of it in glowing terms. Chucks are in good selling, according to the experience of one firm, who in the last three days have done a better business than in any other three consecutive days for some time past. High-grade files are in good demand. Prices of some makes went up after the advance in steel, and there is said to be a disposition to raise certain others. Nuts and bolts have lately been expensive, but there is a tendency toward lower prices. The manufacturers have not as yet taken action in this direction, though some cutting may exist on the part of jobbers. This, in common with other lines of machinists' supplies, feels a dulness in trade pending the end of the year. Prices of mill supplies hold their own pretty well, the situation being not altogether unfavorable.

Woodworking machinery remains dull in the New York district, but trade farther out of town is good. In addition to the Western custom, a large sale in Hartford, Conn., is this week reported.

Engines, Boilers and Pumps.

Reports from the engine trade preponderate on the side of a fair business, at least as far as the high speed engines for electric lighting are concerned, of which the large sizes seem to be in improved inquiry. But it is said that for every order in the field there are at least twenty-five applicants who are trying to cut each others' throats as regards prices, which, no matter what the volume of business may be, are consequently demoralized.

The boiler trade is good, taking it all in all, and prices hold their own well in spite of some weakness in materials. For city trade a favorite type of boiler is the horizontal tubular, of such size and shape that it can conveniently be placed under the sidewalk.

In pumps, the situation seems better this week than last, though not materially changed. Among the lines finding a good market are elevator and large fire pumps. Some of the factories have for a time past been running on night work.

Iron and Other Metals.

It is to be hoped that the pig iron trade reached its low-water mark this week, but the tide has hardly yet begun to flow in. The situation is well understood—it is a stand-off. Bessemer iron has for some time been undeniably weak and a loss of one-half the year's gain has been, to say the least, alarming. Yet a sanguine view of the situation might with justice be taken, especially as regards the New York market, where foundry irons play the principal part. The prospective higher prices of ore and coke will sustain that of iron. A lull in business need not mean decreased consumption. There is invariably a quiet before inventory, and, after the first of the year, a good business is anticipated. A company dealing in special grade foundry irons reports, this week, a sale of 10,000 tons of No. 1 at the price of 30 days ago. An important news item is that of measures being taken for tonnage apportionment between the producers of the Mesabi and the old Lake Superior ores which will prevent disastrous cutting of prices by the Mesabi, which enjoys the advantages of cheap mining and low freights.

Very little is doing in steel billets and inquiries are few. Prices are inclined to weakness, as there is some cutting to obtain orders. Machinery, and similar low grades of steel are in rather quiet demand and are weak in price, though with hardly a quotable change. Considering the season, there is a fair business in machinery steel. Trade in cold rolled steel shafting continues to improve. The present prices are fixed by the combination which controls the market, until after January 1st, at the soonest. Plenty of work is also being done in turned shafting.

The market for wrought-iron pipe and boiler tubes is steady, but quiet. Prices have, of late, been weak, and, for this season of the year, are low.

Copper is still in an unsettled condition, with consumers holding out of the market and prices weaker. According, however, to one authority upon the subject, pressure to sell is less than last week and the tone of the metal improved.

Pig tin is dull, and in great measure governed by speculation. It still inclines to be easier, on account of large shipments, and is selling below the cost of importation.

Lead is in excellent demand and is stiffening in price. Probably from 600 to 1,000 tons have recently been sold in this neighborhood on a basis of about 3.30c., New York delivery. London has advanced to the equivalent of about 3.60c. in this market.

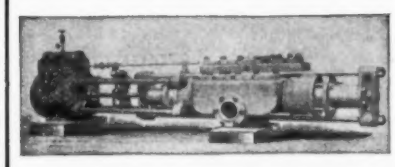
Spelter is firm, dull, featureless and practically unchanged.

QUOTATIONS.

	Saturday Evening.	
Iron—American pig:		
No. 1 X foundry, Northern	$14 00	a14 50
No. 2 X foundry, Northern		a13 50
No. 2 plain, Northern		a13 00
Gray forge, Northern		a12 00
No. 1 foundry, Southern	13 75	a14 00
No. 2 foundry, Southern	13 50	a13 75
No. 1 soft, Southern	13 75	a14 00
No. 2 soft, Southern	13 50	a13 75
No. 3 Southern	13 25	
Gray forge, Southern	12 00	a12 50

Bar Iron—Common, on dock, 1.35 a 1.40c.; refined, on dock, 1.50 a 1.60c.

THE DEANE OF HOLYOKE BOILER FEED PUMPS,



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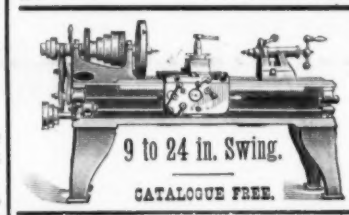

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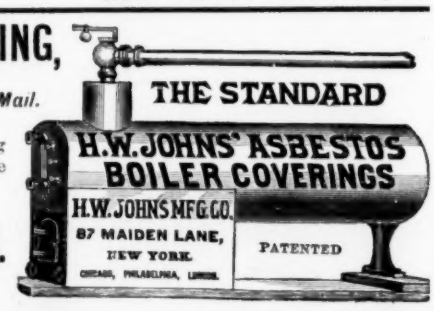

Tool Steel—Ordinary sizes, standard quality, 6 a 7c; extra grades, 11 a 12c.; special grades, 16c. and upwards.
Machinery Steel—2 a 2¼c.
Cold Rolled Steel Shafting—Base, 2¼c. in car loads; 2¾c. in smaller quantities; 3c from store.
Copper—Lake Superior ingot, 10¾ a 11c.; electrolytic, 10¼c.; casting copper, 10⅛ a 10¼c., according to brand.
Tin—Spot price, 14 25c., net cash.
Lead—Common Western, 3.30c., in car load lots.
Spelter—Good Western brands, 3.45 a 3.50c., New York delivery.
Antimony—Cookson's, 8c.; Hallett's, 7c.; Japanese, 6¾ a 6¾c.
Lard Oil—Prime city, 52 a 52½c.

MANUFACTURES

The new paper mill company at Sault Ste. Marie, Mich., will put in four 160-inch paper machines.

The Remington Typewriter Co. are going to add a building, 150x54 feet, six stories high, to their already extensive works at Ilion, N. Y.

The San Antonio & Aransas Pass Railway Co., Yoakum, Texas, will erect a machine shop, 70 feet by 180 feet in size, and other buildings.

The Norwich (Conn.) Folding Paper Carpet Lining Co. has increased its capital stock from $10,000 to $30,000, and will put in more machinery.

The Buffalo Engineering Co. have been authorized to make plans and specifications for new steel locks on the Erie Canal at Lockport, N. Y.

The Garden City Foundry Co., of Chicago, Ill., has commenced with a capital of $25,000. H. B. Gutches and Clark J. Tisdale are the incorporators.

The agents in New York for Chas. Cammel, of Sheffield, Eng., are said to have sold 10,000 tons of steel rails of English make for use on an American road.

The Waltham Manufacturing Company, of Waltham, Mass., are putting an addition on to their shop, 40x140 feet, for the manufacture of their "Orient" bicycles.

The Gilbert Loom Works, of Worcester, Mass., report an improvement in business, and a good demand for some new specialties in the way of improved weaving machinery.

The Geo. Burnham Co., of Worcester, Mass., have purchased the business of G. W. Jordan, manufacturer of planer chucks, and in the future these chucks will be made by them.

The Morton Tin Plate Co., Cambridge, Ohio, have started a new line of work, that of producing roofing tin, and an addition, 30x40 feet, has been made to accommodate this new feature.

The factory of the Wellington Piano Case Co., Leominster, Mass., has been commenced. It is a brick structure, 50 feet by 230 feet, four stories high. It has a brick engine and boiler house, 24 feet by 58 feet. The factory cost, with machinery, $50,000. The concern will employ 125 men.

The Richmond Bicycle Company, of Richmond, Ind., has opened an Eastern branch, in this city, at 97 Chambers street. Allerton, Clarke & Co. are the sales agents. They will carry a stock line of wheels.

The Mason Telephone Co.'s plant at Richmond, Va., has been sold to the Mason-Maxwell Telephone Co., which was organized in Charlestown, W. Va., and capitalized at $100,000. The president is Walter Somers Risley, of New Jersey.

The Southern Railway Co., Alexandria, Va., will erect a roundhouse for 20 locomotives; machine shop, 100 feet by 160 feet; blacksmith and boiler shop, 90 feet by 160 feet; woodworking shop, 90 feet by 160 feet; 300 horse-power engine, etc.

The Lodge & Davis Machine Tool Co., of Cincinnati, Ohio, have added fully $50,000 worth of machinery to their plant during the past 90 days, but are yet unable to supply the demand for bicycle machinery. They have been working a force of vise hands and erectors for some time at night, but are now arranging to run all departments night and day.

Mr. F. C. Fladd, who was formerly manager of the New York branch of the Stiles & Parker Press Co., and at the time of the consolidation with the E. W. Bliss Co. became connected with the latter, has, with others, organized at Watertown, N. Y., the Stiles & Fladd Press Co. Mr. F. S. Stiles will be treasurer, and Mr. Fladd secretary and general superintendent of the new company, which will manufacture various kinds of presses and other tools for sheet metal work.

Landis Bros., of Waynesboro, Pa., write us: Our trade has been very much better of late than at any time heretofore. We have recently received quite a number of orders for our machines. Among them are orders for two of our No. 5 grinding machines and one No. 3 from Paris, and other orders from Russia, England, Toronto, Ont.; Youngstown, Ohio; Poughkeepsie, N. Y.; Windsor, Vt.; Springfield, Ohio; Cleveland, Ohio, and other points. Our present equipment enables us to meet the increased demand, which prospects look favorable to a continuance, inquiries being very active.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Wanted—Pos. as draftsman and designer, having tech. education and shop exp. Box 170, AM. MACH.

Practical machinist wishes position as chief engineer or foreman of repairs in large works. Address Machinist, care AMERICAN MACHINIST.

Wanted—A first-class expert in gilding, plating, etc.; experienced in electrotyping in relief; best references. Address T. J., 100, AMERICAN MACHINIST.

A mechanical engineer, well qualified to design light machinery and tools, wants a position of trust. Illinois, AMERICAN MACHINIST.

Wanted—Three or four 1st-class machinists, skilful on planer, lathe and horizontal boring mill. Apply 115 Plymouth Street, Jersey City, N. J.

(*Continued on Page* 974.)

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INSIST ON HAVING
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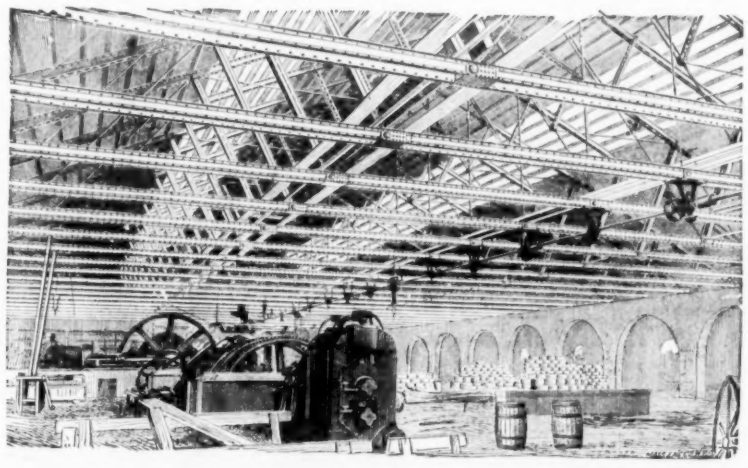
NICHOLSON FILE CO.
PROVIDENCE, R. I., U. S. A.
3000
VARIETIES FILES
[X. F.] & INCREMENT CUT FILES.

THE BERLIN IRON BRIDGE CO.
Office and Works,
No. 8 Railroad Ave., East Berlin, Conn.
CHAS. M. JARVIS, Pres. and Chief Engineer. BURR K. FIELD, Vice-President.
FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

Engineers, Architects and Builders of

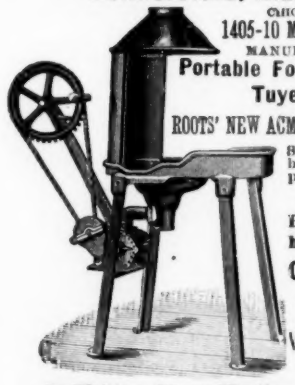


Iron and Steel Bridges and Buildings.

The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Coe Brass Co., at Torrington, Conn. The Roof is over their Rolling Mill, which is a building 118 feet wide and 233 feet long. The line of brick arches, shown on the right, connects with an adjoining Muffle Room, which is also covered with an Iron Truss Roof designed and built by us.

SEND FOR OUR ILLUSTRATED CATALOGUE.

P.H.&F.M. ROOTS,
Connersville, Indiana.
CHICAGO OFFICE:
1405-10 Manhattan Building.
MANUFACTURERS OF
Portable Forges,
Tuyere Irons, Etc.
ROOTS' NEW ACME HAND BLOWERS,
Blow speeded, Force blast, Durable, Compact and Cheap.
Roots' Foundry Blowers, Gas Exhausters, Etc.
COOKE & CO.
Selling Agents,
163 and 165 Washington St.,
NEW YORK.



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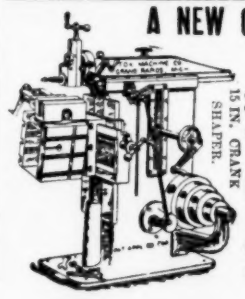
HENRY CAREY BAIRD & CO.,
INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,
, 810 Walnut St., Philadelphia.
☞ Our New and Revised Catalogue of Practical and Scientific Books, 88 pages, 8vo., and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

A NEW CRANK SHAPER.



NOVEL, YET SIMPLE.
Length of stroke changed INSTANTANEOUSLY while IN MOTION.
Get Photos & Prices
NOTHING LIKE IT.
Fox Machine Co.,
325 Nor. Front St.,
Grand Rapids, Mich.
135 Finsbury Pavement, London, England.

A BOOK OF TOOLS

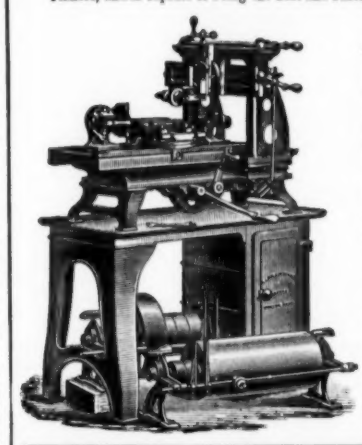
"Accept my thanks for your 'Book of Tools.' The book itself, and its Prefaces or Introductions, are about the most common-sense things I have seen for a long time. I hope and do not doubt that your enterprise and straightforward 'horse-sensy' methods are bringing you the trade and profit deserved."
ROBERT GRIMSHAW, Engineer, New York.

No user or buyer of Tools, Machinery and Supplies can afford to be without this catalogue. It contains 550 pages, over 2,000 illustrations, and is the most comprehensive work of its kind ever issued. Sent post-paid to any address upon receipt of 25 cents in stamps.

CHAS. A. STRELINGER & CO.
DETROIT, MICH.

IF YOU WANT ANYTHING IN THE LINE OF
DROP PRESSES · DROP HAMMERS · STAMPS
OR AUTOMATIC DROP LIFTERS.
SEND FOR CATALOGUE TO
Miner & Peck Mfg. Co.
NEW HAVEN, CONN.
LARGEST LINE IN THE MARKET

POWER OR HAND PLANER,
FOR MODEL MAKERS, EXPERIMENTAL WORK, &c.
Has all the Improved Features Usually Found on High Grade Planers, and is Capable of Doing the Best and Finest Work.



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A. J. WILKINSON & CO.,
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AN OPPORTUNITY.

As I am desirous of retiring from Business, I offer my complete, modern equipped Foundry and Machine Plant for Sale on easy Terms free of Incumbrance. It is well situated on the Main Line of R. R. near N. Y. City. The Tools are adapted to build First Class Machinery, and the Business is thoroughly established throughout the United States. Address AMERICAN MACHINIST, Box 171.

SHAPERS
AND OTHER MACHINE TOOLS.
Special Machinery.
FITCHBURG MACHINE WORKS,
FITCHBURG, MASS., U. S. A.
CATALOG E.

Horizontal Boring and Drilling Machine.

POLISHING WHEELS,
COVERED WITH HEAVY OAK-TANNED LEATHER.
Write for price list with discount, and list of sizes carried in stock.
BUILDERS IRON FOUNDRY,
PROVIDENCE, R. I.

BEVEL GEARS,
Cut Theoretically Correct.
Special facilities for cutting worm wheels.
HUGO BILGRAM,
MACHINIST,
440 N. 12th St., Philadelphia, Pa.

JESSOP'S STEEL
FOR TOOLS, DRILLS, DIES, &c.
ALL KINDS IN STOCK.
Manufactory, SHEFFIELD, ENG.
Chief Am. Office, 91 JOHN ST., N. Y.
WM. JESSOP & SONS, LTD.
Established a century ago.
Medal World's Columbian Exposition 1893.

WORTHINGTON CONDENSER.
ONLY APPARATUS that can MAINTAIN a VACUUM on ENGINES and ELEVATE the discharge WATER to TANK at any height.
This feature is appreciated by PAPER MILLS, SUGAR REFINERIES, COTTON and WOOLEN MILLS.
HENRY R. WORTHINGTON,
NEW YORK, 86 and 88 Liberty St. BOSTON, 70 Kilby St. PHILADELPHIA, 724 Arch St. CLEVELAND, 24 South Water St. CHICAGO, 185 to 189 Van Buren St. ST. LOUIS, Eighth and St. Charles Sts. INDIANAPOLIS, 64 South Pennsylvania St. DETROIT, 155 Jefferson Ave.

Wanted—A first-class draftsman by one of the largest shops; prefer a man who has had experience on Corliss engine work and heavy machinery. Address Box 162, AMERICAN MACHINIST.

Wanted—At once, a first class tool maker, one used to making cutting dies for brass; send references. Wm. L. Gilbert Clock Company, Geo. B. Woodruff, Asst. Supt., Winsted, Conn.

Wanted at once—A mechanical draftsman who has had considerable experience in general machine designing; one who has also had some shop experience preferred. Address Box 169, AM. MACH.

Wanted—By a machinist, position as foreman or tool maker in bicycle factory; 4 years' experience with screw and hub machinery in the manufacture of bicycle wheels. C. A. L., AMERICAN MACHINIST.

Supt. desires change, thor'ly c nvers't with latest methods of producing work economically; have made specialty of forge and mach. work, good executive ability, best refs. Latest Methods, AM. MACH.

Wanted—Work as draftsman by man having experience in both shop and drafting room; technical education. Address Box 167, care AMERICAN MACHINIST.

Wanted—Foreman for tool room in gun factory; a good opening for the right man. State age, experience, wages required, and give references. Box 163, AMERICAN MACHINIST.

Wanted—First-class mechanic to take charge of the construction of steam and gas engines. State age, experience and references. Address Superintendent, Box 715, Cincinnati, Ohio.

A designing draftsman, with technical education, and 18 years' shop and drawing office experience, desires a change; bicycle or automatic machinery preferred. Address G. P., care AMERICAN MACHINIST.

Superintendent wanted—A man with large experience in manufacturing typewriters, sewing machines or guns, etc.; one who has had exp. in control of men and methods to secure the best work economically. Typo, care AM. MACHINIST.

A first-class foundry foreman, with 10 years' experience on all classes of gray iron castings, desires position as foreman of a first-class shop; can handle any number of men. Address I. C., care of AMERICAN MACHINIST.

Superintendent for a machine shop, from 75 to 100 men, is wanted; quite a large variety of work is done; must be sober, understand drawings well, have a good experience, and able to handle men; references required. Address Box 168, AMERICAN MACHINIST.

Wanted—As asst. supt., a technically educated young man, exp'd in duplicating parts of engines by rapid process work, handling men, reducing cost, and increasing output; room for the right man to grow; 1st-class refs. must be inclosed with applications. Address Box 165, AM. MACHINIST.

Wanted—Foundry foreman; one who can work 100 men if necessary, on general machinery castings. One who understands melting and mixing, and can produce *best quality* work at a reasonable cost. No experimenter need apply. Permanent position and good wages. Coke, AM. MACHINIST.

Wanted—An intelligent man in every machine shop in New England to utilize his spare time in raising clubs of subscribers for the AMERICAN MACHINIST; liberal commission. Address, with references, John A. Walker, N. E. Agent, No. 4 Church Street, Dorchester, Mass.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—A first-class key-seater, new. Address Mitts & Merrill, 913 Tilden St., Saginaw, Mich.

Best and cheapest Bolt Header made by C. H. Baush & Sons, Holyoke, Mass.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Drawings, mech., executed at home, at reasonable prices. Draftsman, 277 Clinton St., B'klyn.

Wanted—To secure interest and management of medium size, modern mach. works, by young man, good mech. and business ability; can secure plenty of work. Give full partics. Mech. Eng'r., AM. MACH.

For Sale—Tabor duplex automatic molding machine with 18-inch cylinder; molds two flasks 12x15, or one flask 15x24 inches; perfect condition. Box 94, AMERICAN MACHINIST.

Wanted—Forging, pattern casting and general machine work to do. F. F. Chase Machine Works Plainfield, N. J.

Introduction and negotiation of American patents and machinery to English manufacturers and agents. Write for circular to Geo. Richards, M. I. M. E., Mechanical and Consulting Engineer, No. 5 Laurence Pountney Hill, London, England.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offered to inventors.

Established in 1874.

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COR. LAKE & KIRTLAND STS. CLEVELAND, O.

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5 Neue Promenade, Berlin, C., Germany.

BUSINESS FOR SALE.

We hereby offer for sale our entire business plant, including real estate, tools and fixtures, stock on hand, etc.

The real estate consists of about seven lots on south side of Market St., Corning, N. Y., each 21 ft. by 70 ft., and six lots on north side of Erie Avenue, 21 ft. by 100 ft., all nearly covered with substantial brick buildings, and comprising a complete Machine Shop, Smith Shop, Foundry and Boiler Shop.

The Machinery and Tools are all in complete working order. All will be sold at a very reasonable price.

A fine opportunity is here offered for one or more young men of energy and some capital to engage in a lucrative business.

PRESTON & HEERMANS.

CORNING, N. Y., November 18, 1895.

SECOND-HAND MACHINERY.

80" Gould & Eberhardt Gear Cutter.
26" Pratt & Whitney Chucking Lathe.
60" Triple-geared New Haven Lathe, with chuck jaws.
40" New Haven Back-geared and Power-feed Drill.
32" Double-head Pond Planer.
No. 1 Giant Key Seater.

Send for complete list. Send for catalogue of Bicycle machinery.

PRENTISS TOOL AND SUPPLY CO.,
62 & 64 S. CANAL ST., CHICAGO, ILL.

MACHINERY FOR SALE.

28 in. x 24 in. x 7 ft. New Haven Planer. New.
21 in. Gould & Eberhardt Drill. Good as new.
6 in. Boynton Hand Shaper. " " "
1-4 to 1 1-4 in. Open-die Bolt Cutter. Good as new.
Nos. 1, 3 and 6 Roots Pressure Blowers. A1 condition.
9 x 9 Greenfield Upright Engine. Good as new.
1 8 x 5 x 10 Brass Lined Duplex Pump.
1 12 x 18 Slide Valve Engine.
Lot 6 1-2 in. and 7 1-2 in. Hammered Steel Shafting. Bearings, Friction Clutch Pulleys, etc., less than half value.

COOKE & CO.,
163 and 165 Washington Street, New York.

Second-Hand Machinery.

LATHES.

2 10 in. x 5 ft. Foot & Power.
2 11 in. x 5 ft. Power only.
1 15 in. x 6 ft. Dustin.
1 16 in. x 8 ft. Flather.
2 18 in. x 8 ft. Flather & Prentice.
3 18 in. x 8 ft. Lodge & Davis.
2 21 in. x 10 ft. Pratt & Whitney.
1 27 in. x 10 ft Dustin.
1 28 in. x 12 ft. Blaisdell.
2 30 in. x 14 ft. Lincoln.
1 32 in. x 13 ft. Bement Triple Geared.
1 22 in. x 10 ft. Niles.
1 24 in. x 10 ft. Niles.
1 79 in. Driving Wheel, Bement.
1 48 in. x 18 ft. Gay & Silver.

PLANERS.

3 48 in. x 32 in. x 6 ft. Pond, two heads.
1 48 in. x 32 in. x 8 ft. Pond, two heads.
3 24 in. x 24 in. x 6 ft. W & L., one head.
1 28 in. x 28 in. x 8 ft. Gay & Silver.
1 32 in. x 32 in. x 10 ft. W. & L.
1 38 in. x 38 in. x 10 ft. Aldrich.
1 32 in. x 10 ft. Open Side.
1 60 in. x 60 in. x 22 ft. Hepworth.

DRILLS.

3 22 in. Back Geared.
2 25 in. " & P. F., Snyder.
1 34 in " " Harris.
2 No. 1½ Niles Radial.
2 Suspension Drills.

MILLING MACHINES.

1 No. 1 B. & Sharpe.
2 No. 13 Garvin.
1 No. 15 "
1 No. 2 " Hand, and others.

SHAPERS.

9 in., 12 in., 13 in., 15 in., 20 in.

MISCELLANEOUS.

1 18 in. P. & W. Screw Machine.
1 20 in x 6 ft. Flather "
2 Horiz. B. & D. Machines.
1 Cylinder Borer. P. & A.
1 30 in. Motor Gear Lathe
1 Double Punch and Shear.
1 30 in., Pulley Lathe.
1 Hydraulic Riveter.
2 Bolt Cutters.
1 Nut Tapper.
1 20 in. Pattern Lathe.

Also large stock of other tools. Send for List.

Eastern Branch Niles Tool Works Co.,
136 and 138 Liberty St., NEW YORK CITY.

E. W. BLISS CO.

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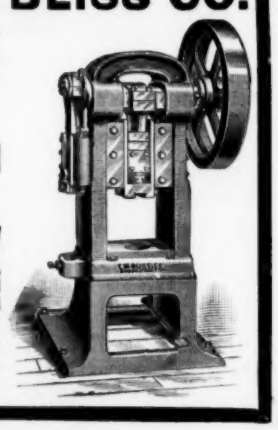
96 W. Wash'n St., CHICAGO.

Presses, Dies, and Special Machinery

For BICYCLE, Electrical, and All Sheet Metal Work.

OWNERS OF
Stiles & Parker Press Co.



SECOND-HAND MACHINE TOOLS.

ENGINE LATHES.

Fifield, 25 x 12, Compound Rest.
15 x 6 Blaisdell, Compound Rest with turret.
13 x 6 Ames, Rise and Fall Rest.
11 x 4 Manu Lathe, Plain Rest.
16 x 7, maker unknown, Plain Rest.
16 x 8 Blaisdell, Plain Rest.
18 x 10 Flather, Plain Rest.
18 x 10 Blaisdell, Plain Rest.
28 x 20 Perkins, Compound Rest.
37 x 14, maker unknown.

PLANERS.

16 in. x 16 in. x 4 ft. Hendey.
20 in. x 20 in. x 4 ft. Putnam.

SHAPERS.

10 in. Juengst, Crank.
12 in. Juengst, Crank.
10 in. Woodand Light, Traverse Head.
18 in. Putnam, Traverse Head.
15 in. Juengst Friction Shaper.

HAND LATHES.

10 in. x 41 in. Garvin.
12 in. x 6 ft. Wright.
12 in. x 5 ft. Back Geared.

MISCELLANEOUS TOOLS.

24 in. Barnes Water Tool Grinder
No. 2 Springfield Water Tool Grinder.
No. 4 Springfield Water Tool Grinder.
Garvin Profiler, 1-spindle.
No. 2 National Bolt Cutter.
60 in. Lincoln Gear Cutter.
26 in. Pulley Lathe.
50 in. Pulley Lathe.
5 in. Cutting-off Machine.
No. 1 Garvin Screw Machine.
36 in. Bliss Power Squaring Shear.
No. 2 C. Worcester Drill Grinder.
21 in. Squaring Shear.
14 ft. Power Draw Bench.
225 lb. Pierce & Noble Drop Press.
100 lb. Stiles Power Drop Press.
75 lb. Drop Press.
No. 31 Eaton Cutting and Drawing Press.
No. 2 Garvin Wire Spring Coiler.
No 6 35 in. Sturtevant Blower.
600 lb. Merrill Power Drop Press.

Also, a large list of other machines. Write for complete list, detailed description and prices.

THE GARVIN MACHINE CO.,
LAIGHT & CANAL STS., NEW YORK.
Also, 51 North 7th St., Philadelphia, Pa.

SPECIAL PRESSES AND DIES FOR ALL KINDS OF BICYCLE WORK.

FERRACUTE MACHINE CO.
New Catalogue. BRIDGETON, N. J., U. S. A.

LeCOUNT'S

HEAVY STEEL DOG.

MANUFACTURED BY
WM. G. LeCOUNT,
Successor to C. W. LeCount,
South Norwalk, Conn.

Send for "Catalog A," Full Line of Machine Tools.

SPECIAL LOT

SECOND-HAND TOOLS

at very low prices before removal.

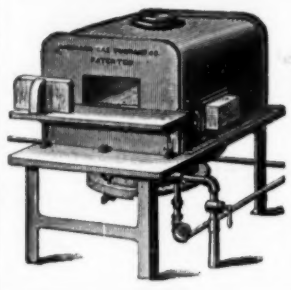
LATHE—72 in. swing, 20 ft. bed, Triple Geared.
" 42 " " risers to 48 in., 12 ft. bed, Triple Geared, Compound Rest, etc., Pratt & Whitney's. A1 order.
" 32 in. swing risers to 36 in., 18 ft. bed, Compound Rest, etc., Fay & Scott's, A1 order.
" 24 in. swing, 12 ft. bed, Compound Rest, Fitchburg.
" 22 in. swing, 12 ft. bed, Compound Rest, Hollow Spindle, 1 9-16 in., Perkins.
" 20 in. swing, 15 ft. bed, Extra Heavy, Compound Rest etc., Pond.
" 18 in. swing, 8 ft. bed, Flather.
" 16 in. swing, 7 ft. bed, Pratt & Whitney.
" 13 in. swing, 6 ft. bed, Blaisdell.
PLANER—37 in. x 37 in. x 11 ft., Betts.
" 36 in. x 36 in. x 8 ft., Niles.
" 32 in. x 32 in. x 8 ft., Pond.
" 26 in. x 26 in. x 8 ft., Powell.
" 26 in. x 26 in. x 8 ft., Gould & Eberhardt.
" 24 in. x 24 in. x 6 ft., Lathe and Morse.
" 22 in. x 22 in. x 5 ft., Pease.
SHAPER—10 in. Stroke Crank, Hewes & Phillips.
" 15 in. " " Gould & Eberhardt.
" 17 in. " " Prentiss.
" 18 in. " Geared, Improved.
" 24 in. " Friction, Hendey.
" 14 in. " Traveling Head, Warren.
DRILL—16 in. Plain, Prentiss.
" 26 in. Complete, Prentiss.
" 32 in. " Extra Heavy, Pond.
" Radial 3 ft. arm, Hilles & Jones.
Universal Milling Machine, Kempsmith's latest.
" " " Cincinnati No. 3.
Plain " " Lincoln Pattern.
" " " Garvin No. 3.
" " " Pratt & Whitney No. 2 Hand.
Upright Boring & Turning Mill, 38 in., 2 Heads.
Horizontal Boring & Drilling Machine, Sellers.
Pipe Machine, 6 in., with Engine, Jarecki.
Boiler Punches, 22 and 36 in. gaps.
Boiler Rolls, 6, 7, 8 and 10 ft. wide.

BICYCLE MACHINERY

CONSISTING OF SCREW MACHINES, MILLING MACHINES, DRILLS, LATHES, PRESSES, SHAPERS, Etc.

J. J. McCABE,
SUCCESSOR TO E. P. BULLARD'S N. Y. Mach'y Warerooms.
14 Dey St., NEW YORK.

AMERICAN GAS FURNACE CO.,



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GAS BLAST FURNACES AND HIGH PRESSURE BLOWERS

For the economical generation and systematic application of HEAT.

CATALOGUES ON APPLICATION.

No. 80 Nassau St., NEW YORK.

English Agency: Chas. Churchill & Co., Ltd., 21 Cross St., Finsbury, London, E. C., England.

LATHES

Planers,
Milling Machines,
Drills,
Turret Machines and Machine Tools.

A LARGE STOCK
always on hand at low prices at

HILL, CLARKE & CO.,
Machinery Merchants,
156 Oliver St. BOSTON.
12 S. Canal St. CHICAGO, Ill.

MACHINERY BARGAINS

BEFORE REMOVAL.

At Phœnix Iron Works, Trenton, N. J.

15 in. x 6 ft. Engine Lathe.
22 " 12 " " "
29 " 13½ " " "
26 " 20 " " "
37 " 30 " " "
71 " 18 " " "
52 in. x 20 ft. Engine Lathe.

19-36 and 50 in. Drills.
Portable Drill.
36 in. x 14 ft. Planer.
12 in. Shaper Traverse Head.
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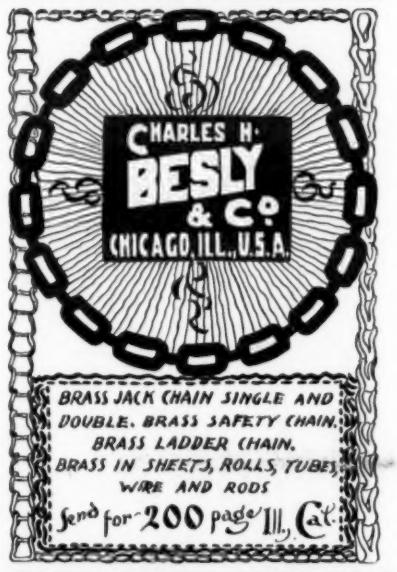
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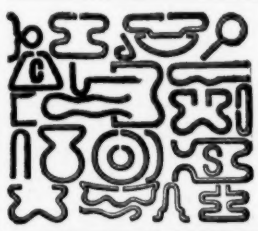

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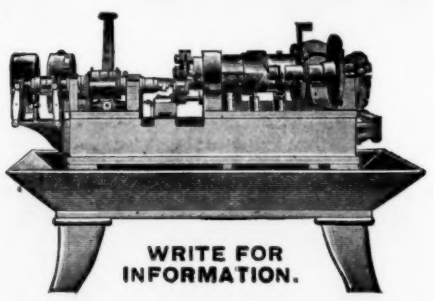

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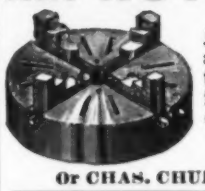

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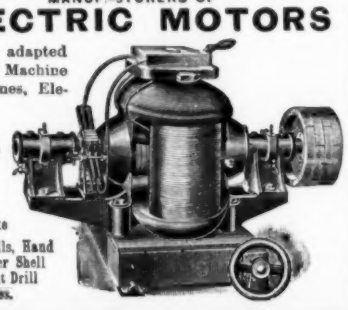

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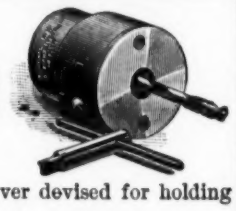

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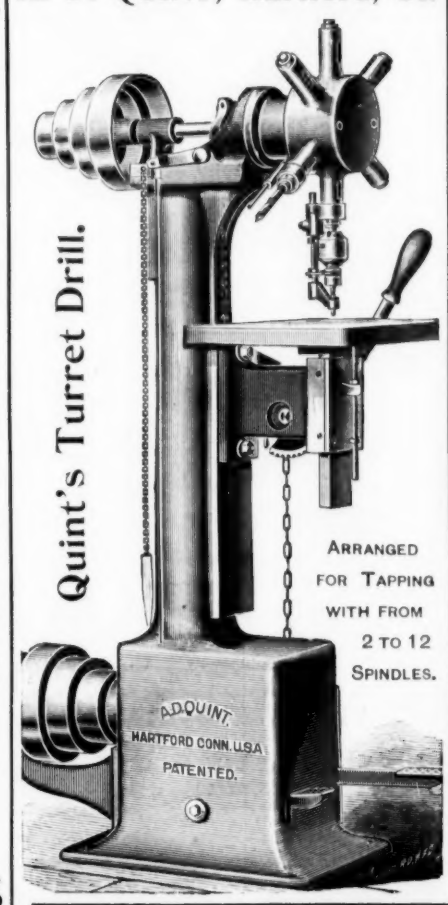

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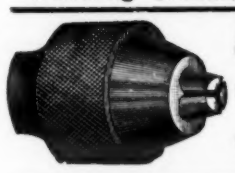

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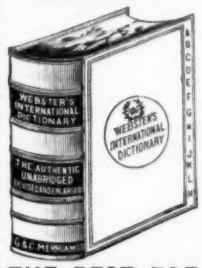

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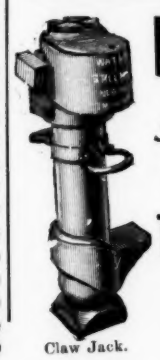

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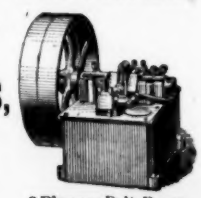

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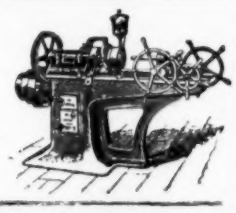

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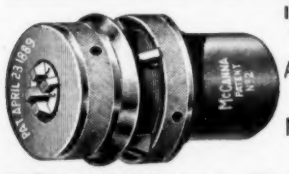

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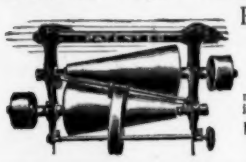

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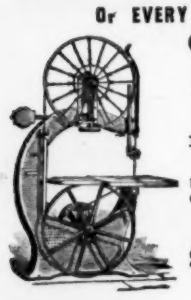

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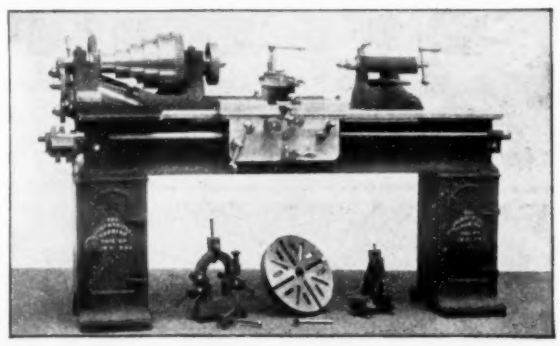

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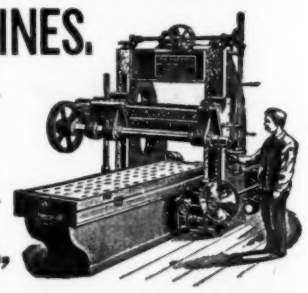

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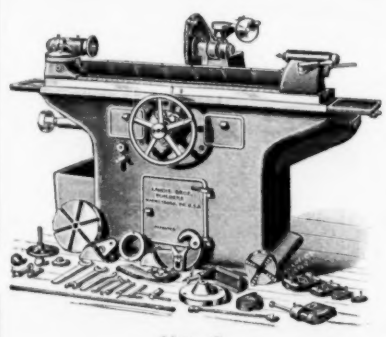

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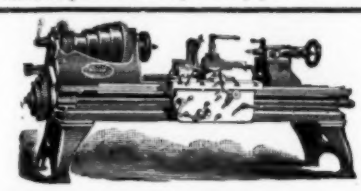

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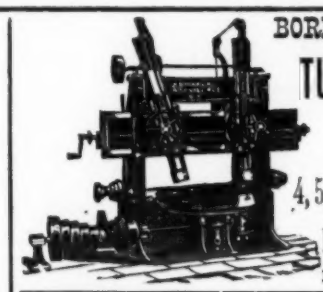

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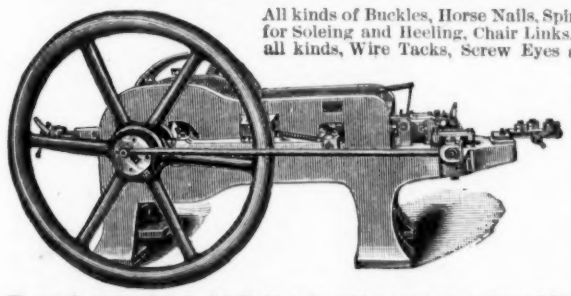

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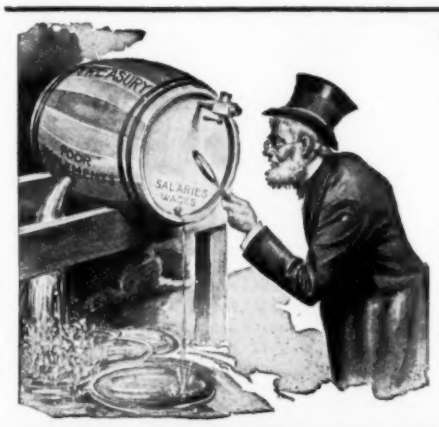

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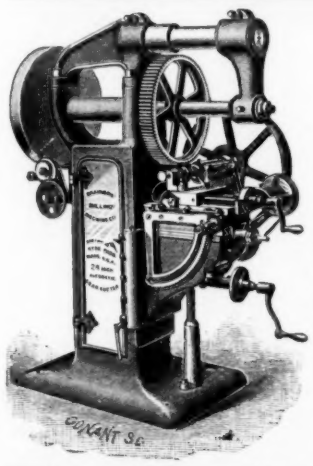

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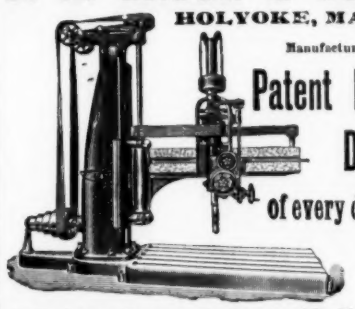

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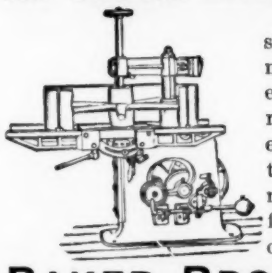

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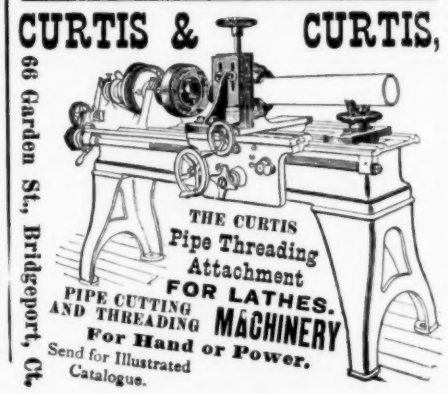

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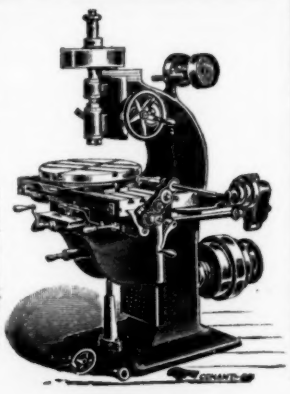

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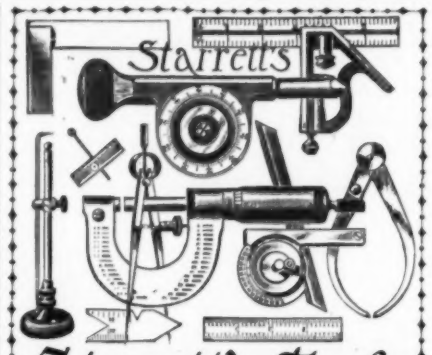

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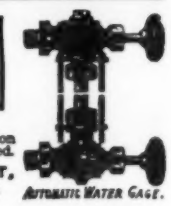
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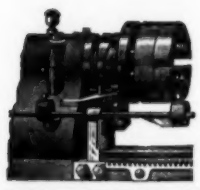

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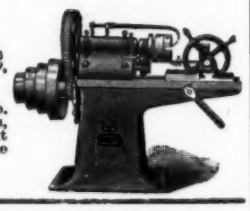

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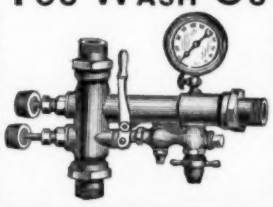

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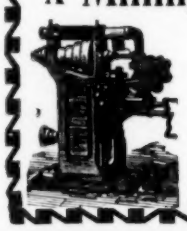

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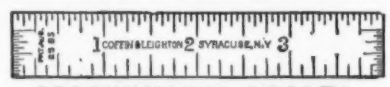

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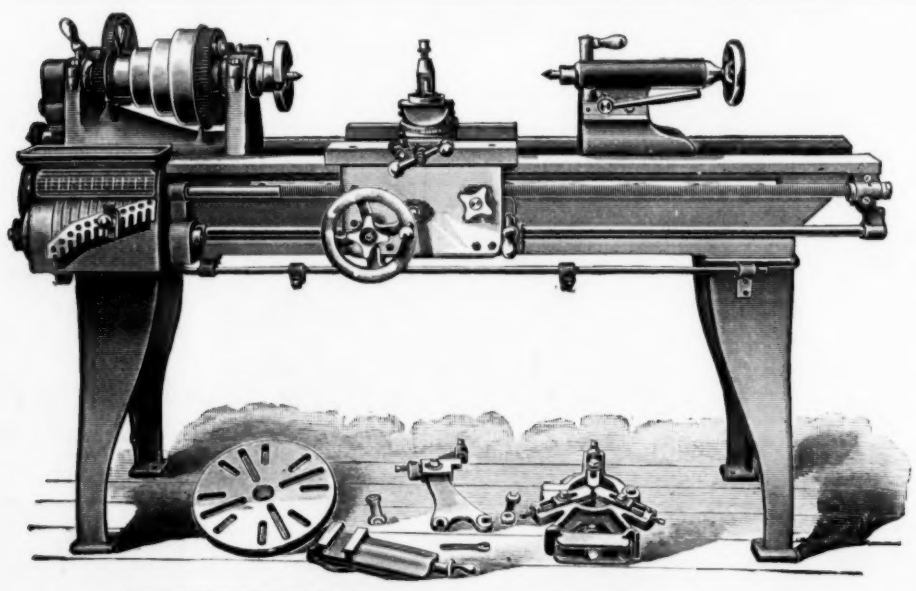

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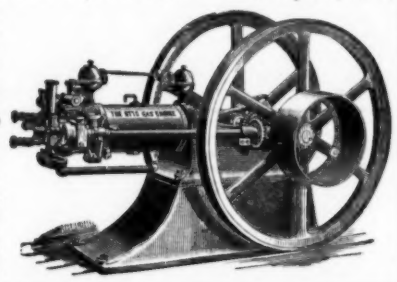

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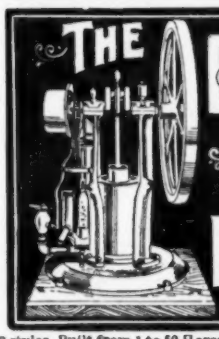

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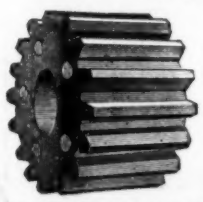

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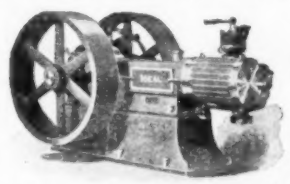

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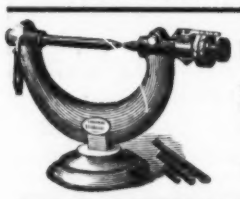

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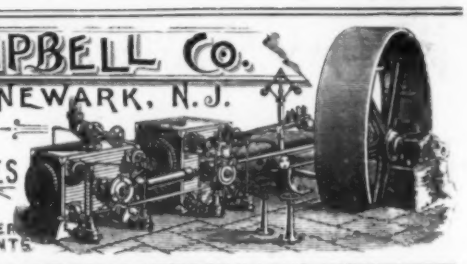

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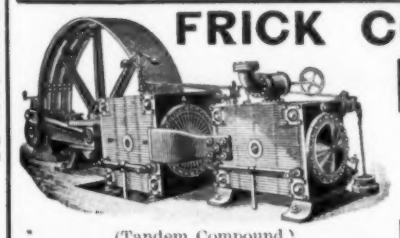

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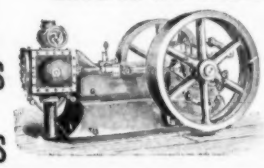

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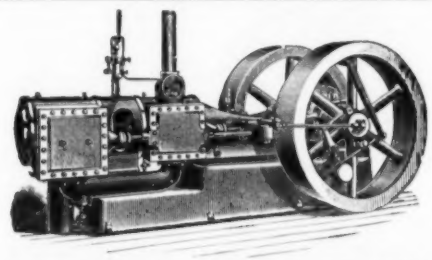

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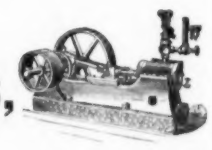

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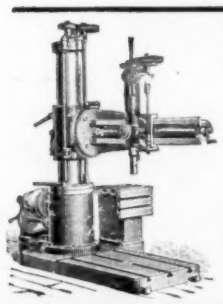

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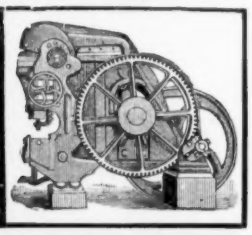

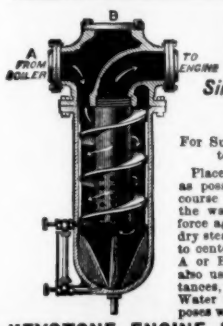

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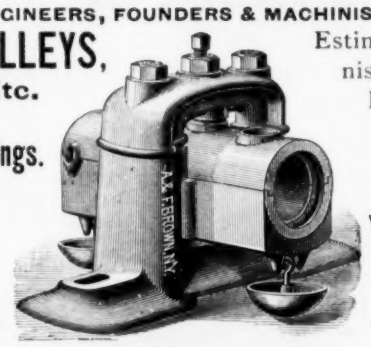

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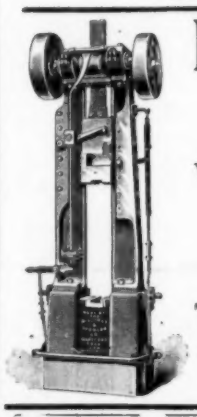

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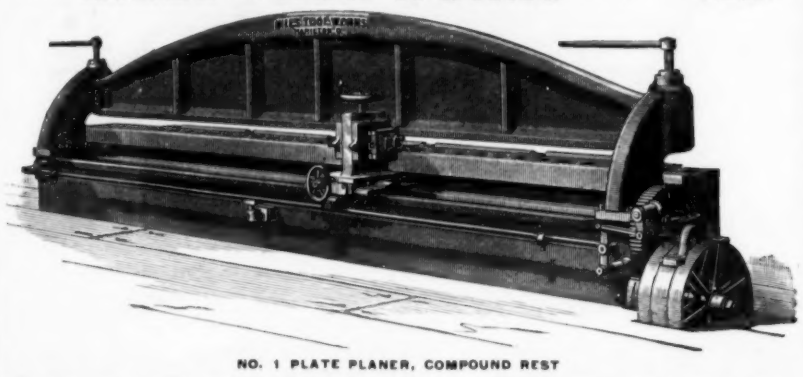

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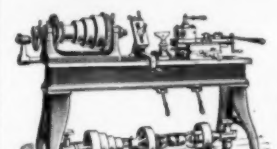

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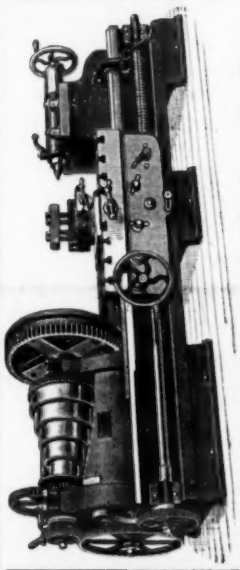

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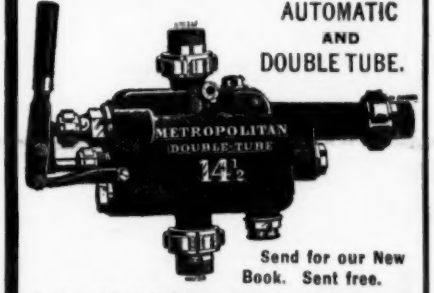

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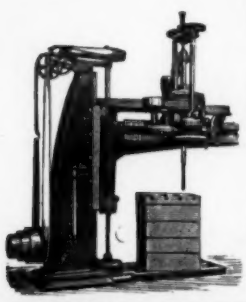

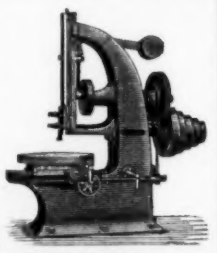

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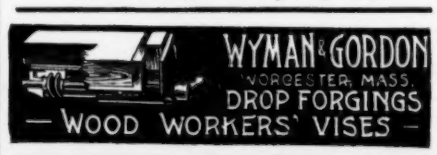

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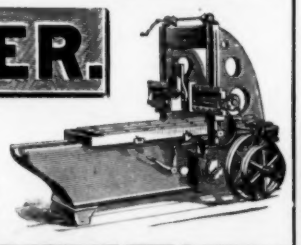

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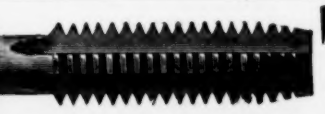

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